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ABSTRACT

This tech prep competency profile for computer-integrated manufacturing technology begins with definitions for four occupations: manufacturing technician, quality technician, mechanical engineering technician, and computer-assisted design/drafting (CADD) technician. A chart lists competencies by unit and indicates whether entire or partial unit is required for each occupation. A second chart lists units under subunits and competencies and indicates for five levels (end of grade 10, grade 12, or Associate Degree program; on-the-job training; or lifelong learning) whether the competency is to be introduced, or reinforced, or whether the student should be competent for entry-level positions. The 39 units are as follows: communications; mathematics; science literacy; technology; employability skills; professionalism; teamwork; quality assurance; technical recording and reporting; computer literacy; workplace safety; manual drafting technology; advanced drafting technology; fundamental, intermediate, and advanced CADD; precision machining; manufacturing technology; computerized numerical control; basic materials science; welding basics; press technology; sheet metal fabrication; electrical test and measurement equipment; geometric dimensioning and tolerancing; hydraulics and pneumatics; basic electronics; electromechanical technology; programmable logic controllers; mechanical power transmission; production methods and costs; engineering mechanics; advanced engineering mechanics; computer programming; computer-based descriptive geometry; product design; design of machines and machine elements; quality; and production planning and control. (YLB)

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COMPUTER-INTEGRATED MANUFACTURING TECHNOLOGY

TECH PREP COMPETENCY PROFILE

MAY 1997

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TECH PREP COMPETENCY PROFILE
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Lakeland Tech Prep Consortium
Tech Prep Competency Profile
Computer-Integrated Manufacturing Technology
May 1997

MA	Manufacturing Technician				
QT	Quality Technician				
MT	Mechanical Engineering Technician				
CT	CADD Technician				
Pg	Unit	MA	QT	MT	CT
1	1. Communications Literacy	X	X	X	X
14	2. Mathematics Literacy	X	X	X	X
22	3. Science Literacy	X	X	X	X
36	4. Technology Literacy	X	X	X	X
37	5. Employability Skills	X	X	X	X
45	6. Professionalism	X	X	X	X
50	7. Teamwork	X	X	X	X
53	8. Quality Assurance	X	X	X	X
55	9. Technical Recording and Reporting	X	X	X	X
56	10. Computer Literacy	X	X	X	X
59	11. Workplace Safety	X	X	X	X
61	12. Manual Drafting Technology	X	X	X	X
65	13. Advanced Drafting Technology (with CADD)	X	X	X	X
66	14. CADD Fundamentals	X	X	X	X
69	15. Intermediate CADD	O	O	O	X
70	16. Advanced CADD				X
72	17. Precision Machining	X	X	X	X
81	18. Manufacturing Technology	X	O	O	O
86	19. Computerized Numerical Control (CNC)	X			X
90	20. Basic Materials Science	X	X	X	X
96	21. Welding Basics	X	X	X	X
98	22. Press Technology	X	X	X	X
99	23. Sheet Metal Fabrication	X	X	X	X
100	24. Electrical Test & Measurement Equipment	X	X	X	X
101	25. Geometric Dimensioning and Tolerancing	X	X	X	X
103	26. Hydraulics and Pneumatics	X	X	X	X
107	27. Basic Electronics	X	X	X	X
111	28. Electromechanical Technology	X	X	X	X
112	29. Programmable Logic Controllers (PLCs)	X			
	(continued)				

X = Entire unit required for this occupation.
O = Partial unit required for this occupation.

Pg	Unit	MA	QT	MT	CT
113	30. Mechanical Power Transmission	O	O	X	O
119	31. Production Methods & Costs	X	X	X	X
121	32. Engineering Mechanics			X	X
123	33. Advanced Engineering Mechanics			X	
125	34. Computer Programming	O	X	X	X
126	35. Computer-Based Descriptive Geometry				X
127	36. Product Design				X
128	37. Design of Machines and Machine Elements			X	
130	38. Quality	O	X		
138	39. Production Planning and Control	X	X		

X = Entire unit required for this occupation.
O = Partial unit required for this occupation.

Lakeland Tech Prep Consortium

Computer-Integrated Manufacturing Technology Tech Prep Competency Profile May 1997

Occupation Definitions

Manufacturing Technician

An individual who applies basic engineering principles and technical skills in support of engineers and other professionals engaged in developing and/or using manufacturing systems and processes. Technical skills should include, but not be limited to:

- machining skills
- print and schematic interpretation
- geometric dimensioning and tolerancing
- basic CADD skills
- basic electrical skills
- computerized numerical control
- programmable logic controllers
- operational diagnosis, repair, and maintenance procedures
- manufacturing methods specification and implementation
- statistical process control
- teamwork skills
- report preparation

Quality Technician

An individual who applies basic engineering principles and technical skills in support of engineers and other professionals engaged in maintaining consistent manufacturing and construction standards. Technical skills should include, but not be limited to:

- quality systems management principles
- technical standards applicable to specific engineering and manufacturing projects
- testing and inspection procedures
- related instrumentation and equipment operation and maintenance
- teamwork skills
- report preparation

(continued)

Mechanical Technician

An individual who applies mathematics and physical principles to design, troubleshoot, or use mechanical, hydraulic or electromechanical devices or systems. Technical skills should include, but not be limited to:

- workplace safety
- CADD skills
- basic electrical/electronics and hydraulic principles
- physics principles and their applications
- materials used in industry and their physical properties
- product, machinery, and systems design
- teamwork skills
- report preparation
- manufacturing methods

CADD Technician

An individual who applies technical knowledge and skills to plan and prepare computerized graphical interpretations or plans and design concepts for mechanical devices and machinery. Technical skills should include, but not be limited to:

- print and schematic interpretation
- proficient drafting and CADD/CAM skills
- drawing designs from approved sketches
- drawing designs from blueprints, designs, mockups, and photoprints
- layouts, drawings, and schematics depicting function, relationship, and assembly sequence of parts and assemblies
- teamwork skills
- report preparation



**LAKELAND TECH PREP CONSORTIUM
TECH PREP COMPETENCY PROFILE**

**ACADEMIC COMPETENCIES FOR
COMPUTER-INTEGRATED MANUFACTURING TECHNOLOGY**

MAY 1997

Key: 10 = by the end of grade 10 12 = by the end of grade 12 AD = by the end of Associate Degree program WS = On-job-training that occurs at actual Work Site LL = Lifelong Learning due to Technological Change	I = Introduce R = Reinforce C = Competent for entry level position
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Unit 1: Communications Literacy (Ohio's Language Arts Model 9-12) * = Manufacturing Industry representatives identified these competencies critical to success in the manufacturing occupations # = Teachers identified these competencies critical to success in the manufacturing occupations					
	10	12	AD	WS	LL
Subunit 1.1: Reading - Structure					
C1.1.1 Exhibit knowledge of language structure					
C1.1.2 Recognize that there may be more than one interpretation of reading selections					
C1.1.3 Recognize various literary devices					
C1.1.4 Recognize and discuss literary elements					
C1.1.5 Develop and use an increasingly sophisticated vocabulary gained through context					
C1.1.6 Apply knowledge of language structure to reading					

Unit 1: Communications Literacy <i>(continued)</i> (Ohio's Language Arts Model 9-12)						
* = Manufacturing industry representatives identified these competencies critical to success in the manufacturing occupations						
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		10	12	AD	WS	LL
Subunit 1.1: Reading - Structure <i>(continued)</i>						
C1.1.7	Explain why there may be more than one interpretation of reading selections					
C1.1.8	Recognize effect of literacy devices on meaning					
C1.1.9	Analyze author's use of literary elements					
C1.1.10	Recognize relationship of structure to meaning					
C1.1.11	Describe various interpretations and meaning levels in reading selections					
C1.1.12	Characterize author's use of literary devices					
C1.1.13	Characterize use of literary techniques					
C1.1.14	Critique a variety of literature with regard to plot, dialogue, theme, setting, and characterization					
* C1.1.15	Apply an expanding vocabulary gained through reading					
C1.1.16	Explain various interpretations and meaning levels in reading selections					
C1.1.17	Analyze use of literary techniques (e.g., extended metaphor, simile, personification, hyperbole, pun, alliteration)					
C1.1.18	Understand use of literary devices (e.g., irony, satire, allegory, onomatopoeia)					
C1.1.19	Analyze and synthesize pieces of literature with regard to plot, dialogue, theme, setting, and characterization					
Subunit 1.2: Reading - Meaning Construction						
C1.2.1	Demonstrate ability to recognize appropriate pre-reading strategies					
* C1.2.2	Describe effectiveness of a reading selection					
*# C1.2.3	Read to clarify personal thinking and knowledge					
# C1.2.4	Support interpretation of text by locating and citing specific information					
C1.2.5	Develop personal response to a variety of literary works					

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Unit 1: Communications Literacy (continued)
(Ohio's Language Arts Model 9-12)

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10 12 AD WS LL

Subunit 1.2: Reading - Meaning Construction (continued)

C1.2.6 Recognize diverse literary interpretations

* C1.2.7 Engage in self-selected reading activities

* C1.2.8 Confirm and extend meaning in reading by researching new concepts and facts

C1.2.9 Self-monitor and apply corrective strategies when communication has been interrupted or lost

C1.2.10 Use features of literary genres to extend meaning

C1.2.11 Assess effectiveness of a selection read

C1.2.12 Use reading as a possible problem-solving strategy to clarify personal thinking and knowledge

C1.2.13 Use knowledge of semantic elements (e.g., figurative language, denotation, connotation, dialect) to clarify meaning when reading

C1.2.14 Predict, recognize, interpret, and analyze themes based on familiarity with author's work

C1.2.15 Compare and contrast literary genres

C1.2.16 Assess validity and quality of selection read

* C1.2.17 Clarify meaning when reading

C1.2.18 Compare personal reaction to critical assessment of a literary selection

C1.2.19 Assess validity of diverse literary interpretations

C1.2.20 Use reference books to find, evaluate, and synthesize information

C1.2.21 Identify tone of a literary work

C1.2.22 Critique validity of diverse literary interpretations

C1.2.23 Integrate personal reaction to and critical assessment of a literary selection

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Unit 1: Communications Literacy (continued)
(Ohio's Language Arts Model 9-12)

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	10	12	AD	WS	LL
Subunit 1.3: Reading - Application					
*# C1.3.1 Select and read material for personal enjoyment and information					
C1.3.2 Read a variety of complete, unabridged works					
* C1.3.3 Employ various reading strategies according to purpose					
C1.3.4 Participate in selection of books, materials, and topics for literature study groups					
C1.3.5 Develop and apply knowledge of the interrelationship of concepts					
C1.3.6 Read selections from a variety of styles and formats, recognizing that style and format influence meaning					
* C1.3.7 Extend value of reading, writing, speaking, viewing, and listening by pursuing, through reading, new concepts and interests developed as a result of these activities					
C1.3.8 Read extensively from a particular author's work and explain elements of author's style					
Subunit 1.4: Reading - Multidisciplinary					
C1.4.1 Connect themes and ideas across disciplines through literature					
C1.4.2 Read to facilitate learning across curriculum					
C1.4.3 Read to develop awareness of human rights and freedom					
C1.4.4 Participate actively in a community of learners					
C1.4.5 Recognize and explain interaction between literature and various cultural domains (e.g., social technological, political, economic)					
C1.4.6 Explore and analyze a variety of cultural elements, attitudes, beliefs, and value structures by men and women of many racial, ethnic, and cultural groups					
C1.4.7 Value thinking and language of others					
C1.4.8 Relate literature to historical period about which or in which it was written					
* C1.4.9 Read to facilitate content learning					

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Unit 1: Communications Literacy (continued) (Ohio's Language Arts Model 9-12)

- * = Manufacturing Industry representatives identified these competencies critical to success in the manufacturing occupations
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10 12 AD WS LL

Subunit 1.5: Writing—Structure

C1.5.1	Develop and expand a repertoire of organizational strategies (e.g., narration, comparison/contrast, and description) through a practice and discussion					
* C1.5.2	Clarify word choice according to audience, topic, and purpose					
* C1.5.3	Locate and correct errors in usage, spelling, and mechanics using a variety of resources					
* C1.5.4	Recognize information gained from primary and secondary sources					
*# C1.5.5	Develop writing which contains ordered, related, well-developed paragraphs with sentences of varied lengths and patterns					
* C1.5.6	Use information from a variety of sources to develop an integrated piece of writing					
C1.5.7	Evaluate and revise writing to focus on such things as audience, tone, and purpose					
C1.5.8	Recognize differences between documentation and reference list styles					
C1.5.9	Develop extended pieces of writing which contain ordered, related, well-developed paragraphs with sentences of varied lengths and patterns					
C1.5.10	Select from a repertoire of organization strategies a pattern appropriate to a topic					
C1.5.11	Synthesize information from a variety of sources					
C1.5.12	Refine word choice and tone according to audience, situation, and purpose					
C1.5.13	Appropriately cite information gained from primary and secondary sources					
C1.5.14	Use style manuals or software to prepare documentation and reference lists					
* C1.5.15	Develop effectively organized pieces of expository writing containing strong voice, clear thesis, and well-developed ideas					
C1.5.16	Identify organization patterns appropriate to writing topic					
* C1.5.17	Respond to others' suggested revisions to a writing piece					

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Unit 1: Communications Literacy <i>(continued)</i> (Ohio's Language Arts Model 9-12) * = Manufacturing industry representatives identified these competencies critical to success in the manufacturing occupations # = Teachers identified these competencies critical to success in the manufacturing occupations		10	12	AD	WS	LL
Subunit 1.6: Writing - Meaning Construction						
C1.6.1	Demonstrate knowledge of the recursive nature of the writing process by applying it appropriately to various topics, situations, and audiences					
C1.6.2	Develop criteria for writing evaluation using scoring guides and peer/teacher assistance to clarify meaning					
* C1.6.3	Respond to others' suggested revisions to a piece of writing					
* C1.6.4	Use word processing, graphics, and publishing aids to construct meaning in writing					
* C1.6.5	Engage in self-initiated writing activities					
C1.6.6	Incorporate personal criteria with generally accepted standards for writing evaluation					
# C1.6.7	Evaluate, analyze, and synthesize information for writing					
C1.6.8	Evaluate own writing using personal and established scoring criteria					
* C1.6.9	Assess personal/peer revisions to a writing piece					
* C1.6.10	Recognize and refine personal writing styles					
Subunit 1.7: Writing - Application						
*# C1.7.1	Apply appropriate writing techniques suitable for varied writing tasks					
*# C1.7.2	Use sentence-combining techniques to improve syntactic fluency and maturity					
*# C1.7.3	Write in response to prompted and self-selected topics in practical, persuasive, descriptive, narrative, and expository domains					
C1.7.4	Develop personal voice in writing					
*# C1.7.5	Consider audience and purpose for writing					
C1.7.6	Develop criteria for selection and potential development of topic					
C1.7.7	Write in a journal or learning log to clarify personal thinking and knowledge					

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Unit 1: Communications Literacy (continued)
(Ohio's Language Arts Model 9-12)

- * = Manufacturing industry representatives identified these competencies critical to success in the manufacturing occupations
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10 12 AD WS LL

Subunit 1.7: Writing - Application (continued)

- * C1.7.8 Apply an expanding vocabulary gained through writing
- * C1.7.9 Make judicious use of reference sources (e.g., dictionary, thesaurus, on-line data base, encyclopedia)
- C1.7.10 Demonstrate, an appreciation for aesthetically pleasing language through word choice and style
- # C1.7.11 Apply revising and editing strategies needed for writing task
- C1.7.12 Vary sentence lengths and patterns
- C1.7.13 Refine personal voice in writing
- C1.7.14 Vary styles and formats for intended purpose and audience
- C1.7.15 Apply criteria for selection and development of topic
- C1.7.16 Participate in peer review of writing in progress
- * C1.7.17 Use transitions between sentences, ideas, and paragraphs in writing
- C1.7.18 Revise and edit papers extensively in preparation for presentation/publication
- C1.7.19 Develop a variety of genres
- C1.7.20 Focus writing and tone on such elements as audience, situation, and purpose
- C1.7.21 Develop topic fully and appropriately
- C1.7.22 Use writing process to clarify personal thinking and knowledge
- C1.7.23 Apply appropriate recursive writing process as suggested by writing task and writer's process
- C1.7.24 Develop an extended piece of writing
- C1.7.25 Revise writing and tone to assure focus on such elements as audience, situation, and purpose
- C1.7.26 Use writing process to write reflectively

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Unit 1: Communications Literacy (continued)
(Ohio's Language Arts Model 9-12)

- * = Manufacturing industry representatives identified these competencies critical to success in the manufacturing occupations
= Teachers identified these competencies critical to success in the manufacturing occupations

10 12 AD WS LL

Subunit 1.8: Writing - Multidisciplinary						
C1.8.1	Use writing process for learning across curriculum					
C1.8.2	Use writing process to demonstrate knowledge of need for human rights and freedom					
C1.8.3	Value and apply collaborative skills in writing process					
C1.8.4	Write in response to reading, speaking, viewing, and listening					
C1.8.5	Use multidisciplinary resources in writing projects					
C1.8.6	Use writing process to facilitate learning across curriculum					
C1.8.7	Recognize value of and engage in collaboration in writing process					
C1.8.8	Use communication processes to develop a published writing piece in collaboration with others					
#	C1.8.9 Record experiences and observations related to content learning					
#	C1.8.10 Apply collaborative skills in writing process					
#	C1.8.11 Write collaboratively with peers					
*	C1.8.12 Use cross-disciplinary resources in writing projects					
Subunit 1.9: Listening/Visual Literacy - Structure						
C1.9.1	Listen to and view a wide variety of genres					
C1.9.2	Become aware of an author's style through listening and viewing a variety of works					
*	C1.9.3 Recognize correct and appropriate grammar, diction, and syntax					
C1.9.4	Expand vocabulary through listening to and viewing varied media					
C1.9.5	Recognize beauty of language					
C1.9.6	Enhance recognition of an author's style through listening and viewing a variety of works					

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Unit 1: Communications Literacy (continued)
(Ohio's Language Arts Model 9-12)

- * = Manufacturing industry representatives identified these competencies critical to success in the manufacturing occupations
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10 12 AD WS LL

Subunit 1.9: Listening/Visual Literacy - Structure (continued)

- * C1.9.7 Recognize use and misuse of language in media
- C1.9.8 Refine knowledge of style through listening and viewing multiple works by the same author
- * C1.9.9 Expand and refine grammar, diction, and syntax through listening
- C1.9.10 Compare authors' styles through viewing and listening to their works
- C1.9.11 Expand knowledge of complex grammar, diction, and syntax issues

Subunit 1.10: Listening/Visual Literacy - Meaning Construction

- *# C1.10.1 Develop critical thinking skills necessary to evaluate media and assess oral presentations
- * C1.10.2 Compare new oral texts to past experiences and knowledge in order to enhance comprehension
- C1.10.3 Recognize how rhythmic patterns, silence, and cadences enhance quality of speech and literature
- * C1.10.4 Focus listening and viewing on themes and/or plots
- # C1.10.5 Gather information from listening and viewing experiences to enhance research
- * C1.10.6 Use critical thinking skills to evaluate media and oral presentations
- C1.10.7 Use prior knowledge and experiences to facilitate comprehension of new oral texts
- C1.10.8 Identify rhythmic and time patterns in speech and literature
- C1.10.9 Identify and analyze themes and/or plots when listening and viewing
- C1.10.10 Use information gathered from listening and viewing experiences to expand research

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Unit 1: Communications Literacy *(continued)*
(Ohio's Language Arts Model 9-12)

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Subunit 1.10: Listening/Visual Literacy-Meaning Construction (cont)

- C1.10.11 Enhance use of critical thinking skills to evaluate media and oral presentations
- C1.10.12 Consider prior knowledge and experiences when attempting to understand the meaning of new texts
- C1.10.13 Appreciate rhythmic and time patterns of speech and literature
- C1.10.14 Select viewing and listening materials to support written text
- C1.10.15 Evaluate media and oral presentations analytically and critically
- C1.10.16 Organize prior knowledge and experiences to comprehend new texts
- C1.10.17 Organize and use viewing and listening materials to support written text

Subunit 1.11: Listening/Visual Literacy - Application

- C1.11.1 Listen attentively during oral reading
- C1.11.2 Use media as stimuli for learning and thinking
- C1.11.3 Develop knowledge of structure through art, music, and literature
- # C1.11.4 Use electronic media to enhance and highlight language learning
- C1.11.5 Listen and view for entertainment and enjoyment
- C1.11.6 Use technology and other media as means of expressing ideas

Unit 1: Communications Literacy (continued)
(Ohio's Language Arts Model 9-12)

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Subunit 1.12: Listening/Visual Literacy - Multidisciplinary

- C1.12.1 Facilitate learning across curriculum through critical listening and viewing
- C1.12.2 Engage in individual, small-group, and whole-group listening and viewing activities
- C1.12.3 Develop language arts (e.g., viewing, listening) projects collaboratively
- C1.12.4 Investigate language and cultural differences through listening and viewing activities
- C1.12.5 Participate in a community of learners through productive listening

Subunit 1.13: Oral Communication - Structure

- *# C1.13.1 Refine oral communication skills
- *# C1.13.2 Demonstrate knowledge of grammar, usage, and syntax when presenting
- C1.13.3 Select topics and vocabulary suitable to audience
- C1.13.4 Organize notes and ideas for speaking
- # C1.13.5 Use language imaginatively
- C1.13.6 Modulate voice to meaning when interpreting literature orally
- C1.13.7 Organize notes and ideas for formal, semiformal and informal presentations of information
- # C1.13.8 Refine speaking techniques for formal, semiformal, and informal settings
- C1.13.9 Develop repertoire of organizational strategies for presenting information orally
- C1.13.10 Expand vocabulary to fit topic
- # C1.13.11 Select topics suitable to audience, situation, and purpose
- C1.13.12 Select appropriate strategies when organizing notes and ideas for speaking

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Subunit 1.14: Oral Communications - Meaning Construction

- * C1.14.1 Make connections between prior knowledge and new information for oral presentations
- C1.14.2 Participate in informal speaking activities
- # C1.14.3 Use interviewing techniques to gather information
- C1.14.4 Communicate orally to entertain and to inform
- C1.14.5 Participate in group communication activities
- * C1.14.6 Take and organize notes when preparing speech/presentation
- C1.14.7 Interpret texts orally to illustrate meaning
- C1.14.8 Respond to needs of various audiences
- C1.14.9 Gather and assess information for speaking
- C1.14.10 Communicate orally to inform and persuade
- C1.14.11 Prepare and deliver formal speech/presentation
- C1.14.12 Participate in a variety of oral interpretations
- C1.14.13 Assess needs of audience and adjust language and presentation according to their knowledge
- C1.14.14 Analyze and synthesize information for speaking
- C1.14.15 Describe effectiveness of literary selection
- C1.14.16 Describe topic or idea in order to clarify personal/audience thinking
- C1.14.17 Analyze and synthesize information gathered from a variety of sources for speaking
- C1.14.18 Describe validity and/or quality of a literary selection and justify selection
- C1.14.19 Interpret orally a variety of literature
- * C1.14.20 Describe topic or idea to clarify meaning for others

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Subunit 1.15: Oral Communications - Application

*# C1.15.1 Become proficient at using interviewing techniques

*# C1.15.2 Give an oral interpretation for a specific audience

C1.15.3 Develop and apply oral communication skills for cooperative/collaborative learning

C1.15.4 Use oral communication for a variety of purposes and audiences (e.g., negotiations, book reviews, rationales)

*# C1.15.5 Develop and apply decision-making strategies

* C1.15.6 Practice interviewing techniques

C1.15.7 Apply interviewing techniques to purposeful interviews

C1.15.8 Focus oral interpretation on a specific audience

Subunit 1.16: Oral Communications - Multidisciplinary

*# C1.16.1 Value thinking and language of others

C1.16.2 Develop oral projects collaboratively

C1.16.3 Be involved in individual, small-group, and whole-group language activities

C1.16.4 Participate actively in a community of learners

C1.16.5 Investigate language and cultural differences through oral language activities

Unit 2: Mathematics Literacy

(Ohio's Secondary Mathematics Model 9-12)

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Subunit 2.1: Numbers and Number Relations

* C2.1.1 Compare, order, and determine equivalence of real numbers

*# C2.1.2 Estimate answers, compute, and solve problems involving real numbers

C2.1.3 Compare and contrast real number system, rational number system, and whole number system

C2.1.4 Extend knowledge to complex number system and develop facility with its operation

Subunit 2.2: Measurement

*# C2.2.1 Estimate and use measurements

*# C2.2.2 Understand need for measurement and probability that any measurement is accurate to some designated specification

*# C2.2.3 Understand and apply measurements related to power and work

C2.2.4 Understand and apply measurement concepts of distance-rate-time problems and acceleration problems

C2.2.5 Use real experiments to investigate elasticity, heat, sound, electricity, magnetism, light, acceleration, velocity, energy, and gravity

*# C2.2.6 Use real-world problem situations involving mass and weight

C2.2.7 Use real-world problem situations involving simple harmonic motion

C2.2.8 Establish ratios with and without common units

*# C2.2.9 Construct and interpret maps, tables, charts, and graphs as they relate to real-world mathematics

C2.2.10 Understand and solve rate-change problems

C2.2.11 Understand and solve right triangle relationships as they relate to measurement, specifically to Pythagorean theorem

Unit 2: Mathematics Literacy (continued)

(Ohio's Secondary Mathematics Model 9-12)

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Subunit 2.2: Measurement (continued)

C2.2.12 Graph and interpret ordered pairs

C2.2.13 Compute total sales from a variety of items

C2.2.14 Comprehend and compute rates of growth or decay

C2.2.15 Comprehend, compute, and interpret real problems involving annuities

*# C2.2.16 Develop an ability to identify real problems and provide possible solutions

*# C2.2.17 Express and apply different types of measurement scales

C2.2.18 Identify area and volume

Subunit 2.3: Estimation and Mental Computation

C2.3.1 Use estimation to eliminate choices in multiple-choice tests

C2.3.2 Use estimation to determine reasonableness of problem situations in a wide variety of applications

C2.3.3 Estimate shape of graphs of various functions and algebraic expressions

*# C2.3.4 Use mental computation when computer and calculator are inappropriate

Subunit 2.4: Data Analysis and Probability

*# C2.4.1 Organize data into tables, charts, and graphs

C2.4.2 Understand and apply measures of central tendency, variability, and correlation

C2.4.3 Use curve fitting to predict from data

C2.4.4 Use experimental or theoretical probability, as appropriate, to represent and solve problems involving uncertainty

C2.4.5 Use computer simulations and random number generators to estimate probabilities

Unit 2: Mathematics Literacy (continued)

(Ohio's Secondary Mathematics Model 9-12)

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Subunit 2.4: Data Analysis and Probability (continued)					
C2.4.6 Test hypotheses using appropriate statistics					
# C2.4.7 Read, interpret, and use tables, charts, and graphs to identify patterns, note trends, draw conclusions, and make predictions					
C2.4.8 Identify probabilities of events involving unbiased objects					
# C2.4.9 Use sampling and recognize its role in statistical claims					
# C2.4.10 Design a statistical experiment to study problem, conduct experiment, and interpret and communicate outcomes					
# C2.4.11 Describe normal curve in general terms and use its properties					
C2.4.12 Create and interpret discrete probability distributions					
C2.4.13 Understand concept of random variable					
C2.4.14 Apply concept of random variable to generate and interpret probability distributions, including binomial, uniform, and chi square					
Subunit 2.5: Algebra					
# C2.5.1 Describe problem situations by using and relating numerical, symbolic, and graphical representations					
# C2.5.2 Use language and notation of functions in symbolic and graphing settings					
C2.5.3 Recognize and use equivalent zeros of a function, roots and the solution of an equation in terms of graphical and symbolic representations					
C2.5.4 Describe and use logic of equivalence in working with equations, inequalities, and functions					
# C2.5.5 Develop graphical techniques of solution for problem situations involving functions					
C2.5.6 Explore and describe characterizing features of functions					
C2.5.7 Make arguments and proofs in algebraic settings					
C2.5.8 Factor difference of two squares					

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Unit 2: Mathematics Literacy (continued)
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Subunit: 2.5 Algebra (continued)

* C2.5.9	Identify slope, midpoint, and distance					
C2.5.10	Explore and combine rational functions					
C2.5.11	Explore factoring techniques					
C2.5.12	Solve quadratic equations by factoring and formula					
* C2.5.13	Set up and solve linear equations					
C2.5.14	Solve systems of linear equations with two variables					
C2.5.15	Describe geometric situations and phenomena using variables, equations, and functions					
C2.5.16	Describe measures of central tendency, mean, median, mode, and variance algebraically and graphically					
C2.5.17	Represent inequalities on number line and in coordinate plane					
C2.5.18	Use coordinate arguments in making geometric proofs					
C2.5.19	Symbolize transformations of figures and graphs					
* C2.5.20	Explore geometric basis for functions of trigonometry					
C2.5.21	Graph linear functions					
C2.5.22	Develop and use vectors to represent direction and magnitude including operations					
C2.5.23	Use polar and parametric equations to describe, graph, and solve problem situations					
C2.5.24	Represent sequences and series as functions both algebraically and graphically					
C2.5.25	Explore recursive functions and procedures using spreadsheets, other computer utilities, and appropriate notions					
C2.5.26	Describe and solve algebraic situations with matrices					
C2.5.27	Describe and use inverse relationship between functions including exponential and logarithmic					

Unit 2: Mathematics Literacy (continued)
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Subunit 2.5: Algebra (continued)					
C2.5.28 Analyze and describe errors and error sources that can be made when using computers and calculators to solve problems					
*# C2.5.29 Decide whether problem situation is best solved using computer, calculator, paper and pencil, or mental arithmetic/estimation techniques					
C2.5.30 Explore relationships between complex numbers and vectors					
C2.5.31 Make arguments concerning limits, convergence and divergence in context involving sequences, series, and other types of functions					
C2.5.32 Represent transformations in plane with matrices					
C2.5.33 Contrast and compare algebra's of rational, real, and complex numbers with characteristics of a matrix algebra system					
C2.5.34 Construct polynomial approximations of a function over specified intervals of convergence					
C2.5.35 Examine complex numbers as zeros of functions					
C2.5.36 Translate verbal statements into symbolic language					
* C2.5.37 Simplify algebraic expressions					
C2.5.38 Use laws and exponents (including scientific notation)					
C2.5.39 Expand and extend idea of vectors and linear algebra to higher dimensional situations					
C2.5.40 Use the idea of independent basis elements for a vector space and associated fundamental concepts of finite dimensional linear algebra					
C2.5.41 Develop and communicate arguments about limit situations					
C2.5.42 Use matrices to describe and apply transformations					
C2.5.43 Develop and use polar and parametric equations to represent problem situations					
C2.5.44 Explore proofs by mathematical induction					

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Unit 2: Mathematics Literacy (continued)

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Subunit 2.6: Geometry							
*#	C2.6.1	Create and interpret drawings of three-dimensional objects					
#	C2.6.2	Represent problem situations with geometric models and apply properties of figures					
#	C2.6.3	Apply Pythagorean theorem					
*#	C2.6.4	Demonstrate knowledge of angles and parallel and perpendicular lines					
	C2.6.5	Explore inductive and deductive reasoning through applications to various subject areas					
	C2.6.6	Translate between synthetic and coordinate representations					
#	C2.6.7	Identify congruent and similar figures using transformation with computer programs					
	C2.6.8	Deduce properties of figures using transformations and coordinates					
*	C2.6.9	Use deductive reasoning					
#	C2.6.10	Explore compass and straightedge constructions in context of geometric theorems					
	C2.6.11	Demonstrate knowledge of and ability to use proof					
	C2.6.12	Use variety of proof techniques (e.g., synthetic, transformational, and coordinate)					
	C2.6.13	Use variety of proof formats, including T-proof (i.e., two-column) and paragraph proof					
	C2.6.14	Explore different proof strategies					
	C2.6.15	Investigate different proofs of theorems					
	C2.6.16	Develop knowledge of an axiomatic system					
	C2.6.17	Apply transformations and coordinates in problem solving					
#	C2.6.18	Represent problem situations with geometric models and apply properties of figures					
	C2.6.19	Deduce properties of figures using vectors					

Unit 2: Mathematics Literacy (continued) (Ohio's Secondary Mathematics Model 9-12) * = Manufacturing industry representatives identified these competencies critical to success in the manufacturing occupations # = Teachers identified these competencies critical to success in the manufacturing occupations					
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Subunit 2.6: Geometry (continued)					
C2.6.20 Analyze properties of Euclidean transformations and relate translations to vectors					
C2.6.21 Apply vectors in problem solving					
C2.6.22 Develop further knowledge of axiomatic systems by investigating and comparing various geometry's					
Subunit 2.7: Patterns, Relations, and Functions					
C2.7.1 Model real-world phenomena with polynomial and exponential functions					
C2.7.2 Explore relationship between zeros and intercepts of functions					
C2.7.3 Translate among tables, algebraic expressions, and graphs of functions					
# C2.7.4 Use graphing calculator or computer to generate graph of a function					
C2.7.5 Explore relationship between a linear function and its inverse					
C2.7.6 Describe and use characteristics of polynomial functions in problem-solving situations					
C2.7.7 Explore conic sections and graph using graphing calculator or computer					
* C2.7.8 Apply trigonometric functions to problem situations involving triangles					
C2.7.9 Discover relationships between algebraic description, kind, and properties of conic					
C2.7.10 Explore periodic real-world phenomena using sine and cosine functions					
C2.7.11 Analyze effects of parameter changes on graphs					
# C2.7.12 Use graphing calculator or computer to graph functions					
C2.7.13 Develop an knowledge of rational and transcendental functions					

Unit 2: Mathematics Literacy (continued)
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Subunit 2.7: Patterns, Relations, and Functions (continued)					
C2.7.14 Understand connections between trigonometric and circular functions					
C2.7.15 Use circular functions to model periodic real-world functions					
* C2.7.16 Solve trigonometric equations and verify trigonometric identities					
C2.7.17 Understand connections between trigonometric, exponential, and logarithmic functions and polar coordinates, complex numbers, and series					
# C2.7.18 Model real-world phenomena with a variety of functions					
C2.7.19 Graph using polar coordinates					
# C2.7.20 Explore graphs in three dimensions					
# C2.7.21 Explore functions of several variables					
C2.7.22 Explore recursive functions using spreadsheets and/or programming languages					

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Unit 3: Science Literacy (Ohio's DRAFT Science Model 9-12)							
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Subunit 3.1: Scientific Inquiry							
#	C3.1.1	Check the appropriateness and accuracy of measures and computations using various strategies (e.g., estimations, unit analysis, determination of significant figures)					
*#	C3.1.2	Use ratios, proportions, and probabilities in appropriate problem situations					
*#	C3.1.3	Translate information from and represent information in various forms with equal ease (e.g., tables, charts, graphs, diagrams, geometric figures)					
	C3.1.4	Use existing algebraic formulas and create new ones in appropriate problem-solving situations					
	C3.1.5	Estimate and justify probabilities of outcomes of familiar situations based on experimentation and other strategies					
#	C3.1.6	Invent apparatus and mechanical tools needed to perform unique tasks in various situations					
	C3.1.7	Identify, compare, and contrast different modes of inquiry, habits of mind, and attitudes and dispositions					
#	C3.1.8	Design investigations that are safe and ethical (i.e., obtain consent and inform others of potential outcomes, risks and benefits, and show evidence of concern for human health and safety, concern for non-human species)					
*#	C3.1.9	Make and read scale drawings, maps, models, and other representations to aid planning and understanding					
	C3.1.10	Seek elaboration and justification of data and ideas, and reflect on alternative interpretations of the information					
#	C3.1.11	Utilize appropriate units for counts and measures					
#	C3.1.12	Create and use databases (electronic and other) to collect, organize, and verify data and observations					
#	C3.1.13	Design and conduct investigations with multiple variables					
#	C3.1.14	Communicate the results of investigations clearly in a variety of situations					
#	C3.1.15	Examine relationships in nature, offer alternative explanations for the observations, and collect evidence that can be used to help judge among explanations					

Unit 3: Science Literacy (continued) (Ohio's DRAFT Science Model 9-12) • = Manufacturing industry representatives identified these competencies critical to success in the manufacturing occupations # = Teachers identified these competencies critical to success in the manufacturing occupations					
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Subunit 3.1: Scientific Inquiry (continued)					
C3.1.16 Trace the development (e.g., history, controversy, and ramifications) of various theories, focusing on supporting evidence and modification with new evidence					
# C3.1.17 Select, invent, and use tools, including analog and digital instruments, to make and record direct measurements					
# C3.1.18 Observe and document events and characteristics of complex systems					
# C3.1.19 Explain the influence of perspective (e.g., spatial, temporal, and social) on observation and subsequent interpretations					
# C3.1.20 Create multiple representations of the same data using a variety of symbols, descriptive languages, mathematical concepts, and graphic techniques					
# C3.1.21 Generate testable hypotheses for observations of complex systems and interactions					
C3.1.22 Document potentially hazardous conditions and associated risks in selected homes and public areas					
C3.1.23 Participate in public debates, relying on documented and verified data to construct and represent a position on scientific issues					
C3.1.24 Construct and test models of physical, biological, social, and geological systems					
C3.1.25 Read, verify, debate, and, where necessary, refute research published in popular or technical journals of science (e.g., <i>Discover</i> , <i>Omni</i> , <i>Popular Mechanics</i>)					
# C3.1.26 Explore discrepant events and develop and test explanations of what was observed					
# C3.1.27 Conduct theory-based research using surveys, observational instruments, and other methods					
*# C3.1.28 Modify personal opinions, interpretations, explanations, and conclusions based on new information					
# C3.1.29 Analyze error and develop explanations in various domains					

Unit 3: Science Literacy (continued)

(Ohio's DRAFT Science Model 9-12)

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Subunit 3.1: Scientific Inquiry (continued)						
C3.1.30	Formulate taxonomic schemes based upon multivariate models that help to explain similarities and differences in form, distribution, behavior, survival, and origin of objects and organisms					
C3.1.31	Demonstrate various logical connections between related concepts (e.g., entropy, conservation of energy)					
*#	C3.1.32 Account for discrepancies between theories and observations					
#	C3.1.33 Analyze the changes within a system when inputs, outputs, and interactions are altered					
#	C3.1.34 Create, standardize, and document procedures					
#	C3.1.35 Determine the sources of significant disparities between the predicted and recorded results and change research procedures to minimize disparities					
C3.1.36	Research, locate, and propose applications for abstract patterns (e.g., fractals, Fibonacci sequences, string theory, orbitals)					
C3.1.37	Recognize and utilize classification systems for particles, elements, compounds, phenomena, organisms, and others for exploring and predicting properties and behaviors					
C3.1.38	Suggest and defend alternative experimental designs and data explanations (e.g., sampling, controls, safeguards)					
C3.1.39	Recognize and communicate differences between questions that can be investigated in a scientific way and those that rely on other ways of knowing					
#	C3.1.40 Draw conclusions based on the relationships among data analysis, experimental design, and possible models and theories					
#	C3.1.41 Suggest new questions as a result of reflection on and discussions about their own scientific investigations					

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Unit 3: Science Literacy (continued) (Ohio's DRAFT Science Model 9-12) • = Manufacturing industry representatives identified these competencies critical to success in the manufacturing occupations # = Teachers identified these competencies critical to success in the manufacturing occupations		10	12	AD	LL	WS
Subunit 3.1: Scientific Inquiry (continued)						
C3.1.42	Investigate, assess, and comment on strengths and weakness of the descriptive and predictive powers of science					
# C3.1.43	Create new information from representations of data in a variety of forms (e.g., symbols, descriptive languages, graphic formats) utilizing a variety of techniques (e.g., interpolations, extrapolations, linear regressions, central tendencies, correlations)					
Subunit 3.2: Scientific Knowledge						
C3.2.1	Investigate various types of dynamic equilibrium (e.g., biological, geological, mechanical, chemical)					
C3.2.2	Investigate the relationship between the rates of energy exchange and the relative energy level of components with systems (e.g., trophic levels of ecosystems, osmosis, rate of heating and cooling, storms)					
C3.2.3	Investigate patterns in the natural world (e.g., heredity, crystalline structures, population and resource distributions, diffraction, dispersion, polarization)					
C3.2.4	Investigate models and theories that help to explain the interactions of components in systems (e.g., conservation of mass, energy, and momentum; foodwebs; natural selection; entropy; plate tectonics; chaos; relativity; social-psychology)					
C3.2.5	Investigate degrees of kinship among organisms and groups of organisms					
C3.2.6	Investigate the limits of the definition of life, and investigate organisms and physical systems that exist at or near these limits (e.g. viruses, quarks, black holes)					
# C3.2.7	Investigate estimates and measurements of a wide range of distances and rates of change					
C3.2.8	Investigate the historical development of theories of change over time (e.g., natural selection, continental drift, the big bang, geologic change)					

Unit 3: Science Literacy (continued) (Ohio's DRAFT Science Model 9-12)						
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Subunit 3.2: Scientific Knowledge (continued)						
C3.2.9	Investigate physical and chemical changes in living and non-living systems (e.g., photosynthesis, weathering processes, glaciation, thermal effects of materials, energy cells)					
C3.2.10	Investigate simulations of nuclear change (e.g., radioactivity, half life, carbon dating)					
C3.2.11	Investigate conservation principles associated with physical, chemical, and nuclear changes					
C3.2.12	Formulate descriptions of the impacts of various forms of mechanical and electromagnetic waves on various organisms on each other over time					
C3.2.13	Formulate models and hypotheses for patterns in the natural world (e.g., earth structures, transportation systems, migrations, communications, constellations)					
C3.2.14	Formulate explanations for the influences of objects and organisms on each other over time					
C3.2.15	Formulate and interpret explanations for change phenomena (e.g., mass extinctions, stellar evolution, punctuated equilibrium, molecular synthesis)					
C3.2.16	Formulate and interpret explanations for the magnitudes of diversity at different periods of geologic time (e.g., mutation, global cataclysms, continental drift, competition, mass extinctions)					
C3.2.17	Formulate interpretations of the structure, function, and diversity in a variety of organisms and physical systems (e.g., DNA and RNA variants, nucleons, interaction particles)					
C3.2.18	Formulate understandings of geologic time (e.g., millennia, periods, epochs)					
C3.2.19	Formulate an understanding of the historical development of the model of the universe					
C3.2.20	Formulate explanations and representations of the production, transmission, and conservation of energy in biological and physical systems (e.g., weather, volcanism, earthquakes, electricity, magnetism, cellular respiration)					

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Unit 3: Science Literacy (continued)

(Ohio's DRAFT Science Model 9-12)

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10

12

AD

LL

WS

Subunit 3.2: Scientific Knowledge (continued)

C3.2.21 Formulate models and hypotheses about patterns in the natural world (e.g., social behavior, molecular structure, energy transformation, entropy, randomness, aging, chaos, hormonal cycles)

C3.2.22 Formulate interpretations of the relationship between energy exchange and the interfaces between components within systems

C3.2.23 Formulate estimations for the range of energies within and between various phenomena (e.g., thermal, electromagnetic, thermonuclear, chemical, electrical)

C3.2.24 Formulate explanations for the historical development of descriptions of motions interactions and transformations of matter and energy (e.g., classical Newtonian mechanics, special and general relativity, chaos)

C3.2.25 Formulate models that can be used to describe fundamental molecular interactions in living and non-living systems (e.g., cell membranes, semiconductors).

C3.2.26 Formulate an understanding of the degree of relationship among organisms and objects based on molecular structure (e.g., proteins, nucleic acids)

C3.2.27 Formulate hypotheses and models that may account for observable events (e.g., electricity and magnetism, gravitation, atoms, bonding, chemical reactions, quantum effects, energy flow on biological systems, predator-prey relationships)

C3.2.28 Formulate models and hypotheses about change over time (e.g., natural selection, speciation, punctuated equilibrium, phyletic gradualism, stellar evolution, plate tectonics, radioactive decay, quantum mechanical theory)

C3.2.29 Formulate lists of limitations and propose refinements of standard classification systems (e.g., periodic table, IUPAC, Linnean, standard model)

C3.2.30 Formulate specific cases of limitations and possible exceptions of theories and principles regarding the interactions of moving objects and organisms (e.g., fluid flow in vessels, motion near the speed of light, Heisenberg uncertainty principle, meteorological prediction, local variation and diversity, predicting earthquakes, energy transport in cellular respiration)

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Subunit 3.2: Scientific Knowledge (continued)						
C3.2.31	Formulate plans and contingencies that can be used to accommodate for changes to and stresses on systems (e.g., wildlife and habitat management, corrosion prevention, noise abatement, structure design)					
C3.2.32	Formulate models of molecular, atomic, ionic, and subatomic structures and the physical and biological implications of these structures (e.g., genes, nucleons, quarks)					
C3.2.33	Formulate estimates for a wide range of measurements and scales (e.g., angstroms to light years)					
C3.2.34	Formulate and interpret representations of time from origin to present accounting for phenomena of scale (e.g., smoothness, punctuations, chaos)					
C3.2.35	Formulate interpretations of the historical development of various theories of possible causes of diversity among physical and biological phenomena (e.g., the works of Aristotle, Mendel, Darwin, McClintock)					
C3.2.36	Formulate models and hypotheses that can be used to explain the interactions of components within technological and ecological systems					
Subunit 3.3: Conditions for Learning Science						
C3.3.1	Participate actively in dialogue about and resolution of community issues					
C3.3.2	Assess information from various countries in the original language or translated form to ascertain the perspectives of many cultures					
* C3.3.3	Analyze the scientific ideas presented in science fiction stories and films					
*# C3.3.4	Perform and repeat investigations to verify data, determine regularity, and reduce the impact of experimental error					
C3.3.5	Present the results of investigations in a variety of forums					
* C3.3.6	Contribute to the decisions regarding topics for investigation					

Unit 3: Science Literacy (continued)

(Ohio's DRAFT Science Model 9-12)

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	10	12	AD	LL	WS
Subunit 3.3: Conditions for Learning Science (continued)					
C3.3.7 Use various creative means to communicate interpretations of scientific ideas, concepts, phenomena, and events					
# C3.3.8 Consider the scientific thinking and language of others					
C3.3.9 Individually and collaboratively produce clearly written representations of investigative results					
* C3.3.10 Fulfill responsibilities as part of a research group					
C3.3.11 Select and utilize resources by various criteria (e.g., efficiency, effectiveness, health, safety) that are appropriate to the investigations being conducted by groups					
C3.3.12 Present persuasive argument based on the scientific aspects of controversial issues					
*# C3.3.13 Collect, store, retrieve, and manipulate information with available technologies alleges that may range from hand processes up through computer applications					
C3.3.14 Investigate social issues with a scientific perspective (e.g., human rights, wellness, economics, futurism, environmental ethics)					
# C3.3.15 Keep journals of observations and inferences made over an extended period of time and reflecting upon the impact of these recorded ideas on their thinking and actions					
C3.3.16 Examine the intellect, perspectives, and ethics of notable scientists					
C3.3.17 Collect and analyze observations made over extended periods of time and compare these to scientific theories					
C3.3.18 Create presentations of scientific understandings using diverse modes of expressions					
C3.3.19 Conduct formal scientific debates in the classroom					
C3.3.20 Wonder about the likelihood of events that may occur by chance or coincidence					
C3.3.21 Plan and conduct field trips and experiences for small and large groups					

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Unit 3: Science Literacy (continued) (Ohio's DRAFT Science Model 9-12) * = Manufacturing industry representatives identified these competencies critical to success in the manufacturing occupations # = Teachers identified these competencies critical to success in the manufacturing occupations		10	12	AD	LL	WS
Subunit 3.3: Conditions for Learning Science (continued)						
C3.3.22	Analyze the historical context which leads to and has lead to scientific theories					
C3.3.23	Seek information on topics of personal scientific interest from a variety of sources					
C3.3.24	Conduct learner-developed investigations independently and collaboratively over periods of week and months					
C3.3.25	Listen attentively and critically to presentations of scientific information made by others					
C3.3.26	Conduct analyses of propaganda related to scientific issues					
C3.3.27	Perform investigations that require observations over varying periods of time					
C3.3.28	Experience scientific concepts as interpreted by other cultures through multimedia and local and global specialists					
C3.3.29	Access appropriate technology to perform complicated, time-consuming tasks					
C3.3.30	Relate historical accounts of science to the cultural context in which they were written					
C3.3.31	Work as a contributing member of a collaborative research group					
C3.3.32	Examine the influences of social and political structures and realities that contribute to inquiry about scientific issues					
* C3.3.33	Use technology (e.g., desktop publishing, teleconferencing, teleconferencing, networking) to communicate scientific ideas					
C3.3.34	Explore and analyze a variety of perspectives on science(e.g., works by men and women of many racial, ethnic, and cultural groups)					
C3.3.35	Lead groups of learners of various ages in designing, planning, and conducting science activities					
* C3.3.36	Respect the scientific thinking of others and self					
C3.3.37	Recognize and contrast different epistemologies					

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10 12 AD LL WS

Subunit 3.3: Conditions for Learning Science (continued)

C3.3.38	Develop possible courses of action in response to scientific issues of local and global concern					
C3.3.39	Determine the validity of research conclusions in relation to the design, performance, and results					
C3.3.40	Develop multimedia presentations of group and individual research projects and investigations appropriate for a variety of audiences and forums					
C3.3.41	Produce interesting and scientifically correct stories and present them using various modes of expression					
C3.3.42	Reflect on the ideas and content found in their own journal records					
C3.3.43	Examine ambiguous results and formulate explanations					
C3.3.44	Recognize and synthesize the contributions to scientific thought of individuals from many cultures					
C3.3.45	Construct models and simulations of the component structures and functions of living and non-living entities					
C3.3.46	Lead multi-age groups in the examination of and planned resolution for scientific issues					
C3.3.47	Recognize and choose members of research teams based upon the merit of their ideas and skills					
* C3.3.48	Construct a portfolio of products, documentation, and self-evaluations of his/her own abilities, skills, and experiences					
C3.3.49	Synthesize scientific information from a variety of sources					
C3.3.50	Evaluate and prioritize scientific issues based upon risk-benefit analyses					
C3.3.51	Refining scientific skills from a variety of experiences					

Unit 3: Science Literacy (continued) (Ohio's DRAFT Science Model 9-12)						
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Subunit 3.4: Applications for Science Learning						
#	C3.4.1 Answer student-determined questions by designing databases and drawing inferences from the analyses of the information in these data bases					
	C3.4.2 Make personal behavior decisions by interpreting information that has a scientific basis					
	C3.4.3 Propose courses of action that will validate and demonstrate personal understandings of scientific principles					
	C3.4.4 Guide other learners in their understanding of the interactions of technologies and society at various periods in time					
	C3.4.5 Promote and carry out practices that contribute to a sustainable environment					
	C3.4.6 Study and propose improvements in public services and systems in their community					
	C3.4.7 Choose consumer materials utilizing personal and environmental risk and benefit information					
#	C3.4.8 Make inferences and draw conclusions using databases, spreadsheets, and other technologies					
*#	C3.4.9 Do simple trouble-shooting on common electrical and mechanical systems, identifying and eliminating possible causes of malfunctions					
*	C3.4.10 Construct devices that perform simple, repetitive actions					
	C3.4.11 Investigate the functionality of various geometric shapes in the natural world and the designed world (e.g., translations from spherical to plan representations cause distortions, triangular shapes contribute to rigidity and stability in structures, round shapes minimize boundary for a given capacity)					
	C3.4.12 Make decisions regarding personal and public health					

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	10	12	AD	LL	WS
Subunit 3.4: Applications for Science Learning (continued)					
C3.4.13	Evaluate the social and ecological risks and benefits resulting from the use of various consumer products				
C3.4.14	Analyze the contributions of advances in technology through history to his/her everyday life				
C3.4.15	Identify and reduce risks and threats to a sustainable environment				
C3.4.16	Extend the limits of human capabilities using technological enhancements				
C3.4.17	Use and recognize various propaganda techniques				
C3.4.18	Solve unique problems using the results of systematic analyses				
C3.4.19	Choose everyday consumer products that utilize recent innovative and pass appropriate performance criteria				
C3.4.20	Refine personal career interests through investigations of the diversity of manufacturing, research, service, and invention processes				
C3.4.21	Predict and investigate the working of toys and tools while controlling and manipulating variables (e.g., friction, gravity, forces)				
C3.4.22	Write, follow, modify, and extend instructions (e.g., equations, algorithms, formulas, flow diagrams, illustrations)				
# C3.4.23	Create products, make inferences, and draw conclusions using databases, spreadsheets, and other technologies				
C3.4.24	Predict various scenarios and propose solutions to community issues using scientific information (e.g., actuarial tables, census data, topographic maps, incidence data, climatic data)				

Unit 3: Science Literacy (continued)

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Subunit 3.4: Applications for Science Learning (continued)

C3.4.25	Use scientific evidence to consider options and formulate positions about the health and safety of others and him/herself					
C3.4.26	Search for, use, create, and store objects and information using various strategies and methods of organization and access					
C3.4.27	Research and write environmental impact statements of his/her own design					
C3.4.28	Compare school-based science perspectives with those gained through cutting-edge technological applications					
C3.4.29	Design management plans for natural and human-altered environments (e.g., woodlots, patios, lots, lawns, farmlands, forests)					
C3.4.30	Refine personal career interests					
C3.4.31	Promote public awareness of the interaction of technology with social issues					
C3.4.32	Advocate and propose courses of action for local and global scientific issues using global networks					
C3.4.33	Use appropriate technologies to prepare and present the findings of investigations incorporating tables, graphs, diagrams, and text					
C3.4.34	Make informed consumer choices by evaluating and prioritizing information, evidence, and strategies					
C3.4.35	Develop an informed point-of-view that allows for validation or refutation of the scientific statements and claims of advocated before pursuing courses of action (e.g., contributing support, signing petitions, casting votes)					

Unit 3: Science Literacy (continued) (Ohio's DRAFT Science Model 9-12)						
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Subunit 3.4: Applications for Science Learning (continued)						
C3.4.36	Differentiate between observations and inferences in the exploration of evidence related to personal, scientific, and community issues					
C3.4.37	Develop and write environmental impact and safety and hygiene management plans					
C3.4.38	Use technology to collect, analyze, and communicate information (e.g., electronic networks, desktop publishing, remote sensing, graphing calculators, satellite telemetry, and others)					
* C3.4.39	Design, construct, and market inventions					

Unit 4: Technology Literacy

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		10	12	AD	LL	WS
C.4.1	Demonstrate a systems view of technology based on the interdependence of social, political, economic, and ecological systems					
C.4.2	Assess the career, family, and personal development implications of technological change					
# C.4.3	Demonstrate continuous learning via technology					
C.4.4	Demonstrate global appreciation for technology's potential effects on cultures, geographic areas, and the environment					
C.4.5	Apply historical perspective on technology to the development and use of new technologies					
C.4.6	Apply diverse technologies to store, access, process, create, and communicate information needed to solve problems					
C.4.7	Apply legal principles and ethical conduct to the use of technology					
* C.4.8	Demonstrate competency in mathematics, science, social sciences, communication, and computer skills through the analysis, design, and evaluation of technological systems					
C.4.9	Analyze the potential of alternative technological systems to solve problems and/or to extend human capabilities					
* C.4.10	Use a variety of tools, materials, and equipment in solving problems and extending human capabilities					
C.4.11	Assess risks and benefits of technological developments from an ecological, economic, social, and political perspective					
* C.4.12	Value human diversity as part of a team in suggesting, designing, and testing solutions to technological problems					

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LAKELAND TECH PREP CONSORTIUM
TECH PREP COMPETENCY PROFILE
COMPUTER-INTEGRATED MANUFACTURING TECHNOLOGY

May 1997

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<i>Unit 5: Employability Skills</i>	10	12	AD	WS	LL
Competency: 5.0.1 Develop a flexible career plan	I	R			√
Competency Builders:					
5.0.1.1 Identify current interests and aptitudes	I	R			√
5.0.1.2 Identify common barriers to employment	I	R			√
5.0.1.3 Describe strategies to overcome employment barriers	I	R			√
5.0.1.4 Locate resources for finding employment	I	R			√
5.0.1.5 Research job trends	I	R			√
5.0.1.6 Identify career options	I	R			√
5.0.1.7 Identify advantages and disadvantages of career options (in addition to other than monetary)	I	R			√
5.0.1.8 Identify job requirements	I	R			√
5.0.1.9 Investigate education/training opportunities	I	R			√
5.0.1.10 Evaluate personal strengths and weaknesses	I	R			√

Unit 5: Employability Skills (cont.)		10	12	AD	WS	LL
Competency 5.0.2: Prepare for employment		I	R			
Competency Builders:						
5.0.2.1	Identify traditional and non-traditional employment sources	I	R			
5.0.2.2	Identify present and future employment opportunities (by geographic location)	I	R			
5.0.2.3	Research job opportunities, including non-traditional careers	I	R			
5.0.2.4	Compare salary ranges and benefit packages		I			
5.0.2.5	Compile occupational profile		I			
5.0.2.6	Identify rights and responsibilities of equal employment opportunity laws		I			
5.0.2.7	Design resume and cover letter		C			
5.0.2.8	Secure references		C			
5.0.2.9	Investigate generic and specific employment tests (e.g., civil service exam; drug screening)		I			
5.0.2.10	Use follow-up techniques to enhance employment potential		I			
5.0.2.11	Demonstrate legible written communication skills using correct grammar, spelling, punctuation, and concise wording	I	C			
5.0.2.12	Describe methods for handling illegal questions on job application forms and during interviews		I			
5.0.2.13	Write letter of application	I	C			
5.0.2.14	Research prospective employer and services performed		I			
5.0.2.15	Explain critical importance of personal appearance, hygiene, and demeanor	I	C			
5.0.2.16	Interpret job description		C			
5.0.2.17	Demonstrate appropriate interview question and answer techniques		C			
5.0.2.18	Demonstrate methods for handling difficult interview questions		I			
5.0.2.19	Evaluate job offers		I			
5.0.2.20	Write letter of acceptance	I	C			

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Unit 5: Employability Skills (cont.)	10	12	AD	WS	LL
Competency 5.0.2: Prepare for employment (cont.)					
Competency Builders:					
5.0.2.21 Write letter of declination	I	C			
5.0.2.22 Demonstrate good listening skills	C	R			
5.0.2.23 Ask for the job tactfully		I			
5.0.2.24 Participate in extracurricular activities (e.g., student government, community projects)	I	R			
Competency 5.0.3: Evaluate the importance of self-esteem as an employability skill		C			
Competency Builders:					
5.0.3.1 Identify factors that affect self-esteem		C			
5.0.3.2 Compare effects of low self-esteem and high self-esteem		C			
5.0.3.3 Identify strategies to promote positive self-esteem		C			

Unit 5: Employability Skills (cont.)		10	12	AD	WS	LL
Competency 5.0.4: Demonstrate job retention skills			I		√	
Competency Builders:						
5.0.4.1	Identify employer expectations regarding job performance, work habits, attitudes, personal appearance, and hygiene		I		√	
5.0.4.2	Exhibit appropriate work habits and attitude		I		√	
5.0.4.3	Demonstrate ability to set priorities		I		√	
5.0.4.4	Identify behaviors to establish successful working relationships		I		√	
5.0.4.5	Identify alternatives for dealing with harassment, bias, and discrimination based on race, color, national origin, sex, religion, handicap, or age		I		√	
5.0.4.6	Identify opportunities for advancement		I		√	
5.0.4.7	List reasons for termination		I		√	
5.0.4.8	List consequences of being absent frequently from job		I		√	
5.0.4.9	List consequences of frequently arriving late for work		I		√	
5.0.4.10	Demonstrate interpersonal relations skills (i.e., verbal and written)		I		√	
5.0.4.11	Demonstrate negotiation skills		I		√	
5.0.4.12	Demonstrate teamwork		I		√	
5.0.4.13	Follow chain-of-command		I		√	
5.0.4.14	Exhibit appropriate job dedication		I		√	

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<i>Unit 5: Employability Skills (cont.)</i>	10	12	AD	WS	LL
Competency 5.0.5: Demonstrate knowledge of work ethic		I		√	
Competency Builders:					
5.0.5.1 Define work ethic		C		√	
5.0.5.2 Identify factors that influence work ethic		I		√	
5.0.5.3 Differentiate between law and ethics		I		√	
5.0.5.4 Describe how personal values are reflected in work ethic		I		√	
5.0.5.5 Describe how interactions in the workplace affect personal work ethic		I		√	
5.0.5.6 Describe how life changes affect personal work ethic		I		√	

Unit 5: Employability Skills (cont.)	10	12	AD	WS	LL
Competency 5.0.6: Exhibit appropriate work ethic	I	R			
Competency Builders:					
5.0.6.1 Use time-management techniques	I	R			
5.0.6.2 Avoid personal activity during work hours	I	R			
5.0.6.3 Attend work as scheduled	I	R			
5.0.6.4 Adhere to company and/or governmental policies, procedures, rules, and regulations	I	R			
5.0.6.5 Exercise confidentiality	I	R			
5.0.6.6 Demonstrate appropriate human relations skills	I	R			
5.0.6.7 Adhere to rules of conduct	I	R			
5.0.6.8 Accept constructive criticism	I	R			
5.0.6.9 Offer constructive criticism	I	R			
5.0.6.10 Take pride in work	I	R			
5.0.6.11 Resolve conflict	I	R			
5.0.6.12 Manage stress	I	R			
5.0.6.13 Avoid sexual connotations and harassment	I	R			
5.0.6.14 Adjust to changes in the workplace	I	R			
5.0.6.15 Demonstrate punctuality	I	R			
5.0.6.16 Assume responsibility for personal decisions and actions	I	R			
5.0.6.17 Take responsibility for assignments	I	R			
5.0.6.18 Follow chain-of-command	I	R			

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Unit 5: Employability Skills (cont.)		10	12	AD	WS	LL
Competency 5.0.7: Apply decision-making techniques		I	R			
Competency Builders:						
5.0.7.1	Identify decision to be made	I	R			
5.0.7.2	Identify ownership of decision to be made	I	R			
5.0.7.3	Identify possible alternatives and their consequences	I	R			
5.0.7.4	Make decisions based on facts, legality, ethics, goals, and/or corporate culture	I	R			
5.0.7.5	Apply time factor(s)	I	R			
5.0.7.6	Present decision to be implemented	I	R			
5.0.7.7	Evaluate decision made	I	R			
5.0.7.8	Take responsibility for decision	I	R			
Competency 5.0.8: Apply problem-solving techniques		I	R	R		✓
Competency Builders:						
5.0.8.1	Identify problem	I	R	C		✓
5.0.8.2	Select appropriate problem solving tools/techniques	I	R	R		✓
5.0.8.3	Identify root problem cause(s)	I	R	R		✓
5.0.8.4	Track root problem cause(s)	I	R	R		✓
5.0.8.5	Identify possible solutions and their consequences (e.g., long term, short term, crisis)	I	R	R		✓
5.0.8.6	Use resources to explore possible solutions to problem	I	R	R		✓
5.0.8.7	Contrast advantages and disadvantages of each solution	I	R	R		✓
5.0.8.8	Identify appropriate action	I	R	R		✓
5.0.8.9	Evaluate results	I	R	R		✓
5.0.8.10	Identify post-preventive action	I	R	R		✓

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Unit 5: Employability Skills (cont.)	10	12	AD	WS	LL
Competency 5.0.9: Exhibit characteristics for job advancement	I	R	√	√	
Competency Builders:					
5.0.9.1 Display positive attitude	I	R	√	√	
5.0.9.2 Demonstrate knowledge of position	I	R	√	√	
5.0.9.3 Perform quality work	I	R	√	√	
5.0.9.4 Adapt to changing situations and technology	I	R	√	√	
5.0.9.5 Demonstrate capability/responsibility for different positions	I	R	√	√	
5.0.9.6 Identify characteristics of effective leaders	I	R	√	√	
5.0.9.7 Identify opportunities for leadership in work place/community	I	R	√	√	
5.0.9.8 Demonstrate initiative to affect change in workplace	I	R	√	√	
5.0.9.9 Participate in continuing education/training program	I	R	√	√	
5.0.9.10 Respond appropriately to criticism from employer, supervisor, or other employees	I	R	√	√	
5.0.9.11 Exhibit awareness of corporate culture	I	R	√	√	
5.0.9.12 Prepare for job setbacks	I	R	√	√	
5.0.9.13 Exhibit continual growth based on performance evaluation	I	R	√	√	
5.0.9.14 Set realistic goals	I	R	√	√	

Unit 6: Professionalism	10	12	AD	WS	LL
Competency 6.0.1: Project professional image		I		√	
Competency Builders:					
6.0.1.1 Define professionalism		C		√	
6.0.1.2 Exhibit professional appearance		I		√	
6.0.1.3 Exhibit professional manners		I		√	
6.0.1.4 Project professional attitude		I		√	
6.0.1.5 Identify individuals' vital role in organization		I		√	
6.0.1.6 Exhibit proper etiquette in professionally-related situations		I		√	
Competency 6.0.2: Achieve individual and professional goals		C			
Competency Builders:					
6.0.2.1 Set flexible, realistic, and measurable goals		C			
6.0.2.2 Identify potential barriers to achieving goals		C			
6.0.2.3 Identify strategies for addressing barriers to goal achievement		C			
6.0.2.4 Breakdown long-term goals into short-term goals		C			
6.0.2.5 Prioritize goals		C			
6.0.2.6 Commit to goals		C			
6.0.2.7 Adjust goals		C			
6.0.2.8 Obtain support for goals		C			
6.0.2.9 Reward goals achievement		C			

Unit 6: Professionalism (cont.)	10	12	AD	WS	LL
Competency 6.0.3: Manage personal finances		C			
Competency Builders:					
6.0.3.1 Explain need for personal management records		C			
6.0.3.2 Balance checkbook	I	C			
6.0.3.3 Identify tax obligations		C			
6.0.3.4 Analyze how credit affects financial security		C			
6.0.3.5 Compare types and methods of investment		C			
6.0.3.6 Compare types and methods of borrowing		C			
6.0.3.7 Compare types and methods of insurance		C			
6.0.3.8 Compare types of retirement options/plans		C			
6.0.3.9 Identify discriminatory vs. non-discriminatory expenditures		C			
Competency 6.0.4: Support community well-being	I	C			
Competency Builders:					
6.0.4.1 Identify environmental, educational, and social issues	I	C			
6.0.4.2 Participate in social and/or community activities	I	C			

Unit 6: Professionalism (cont.)		10	12	AD	WS	LL
Competency 6.0.5: Achieve organizational goals			I			
Competency Builders:						
6.0.5.1	Evaluate personal goals in relation to organizational goals		I			
6.0.5.2	Monitor progress by evaluating feedback		I			
6.0.5.3	List responsibilities in relation to organizational goals		I			
6.0.5.4	Accomplish assigned tasks		I			
6.0.5.5	Exercise responsibility in relation to organizational goals		I			
6.0.5.6	Set appropriate personal performance standards		I			
6.0.5.7	Communicate goals with supervisor and peers		I			
6.0.5.8	Demonstrate knowledge of products and services		I			
6.0.5.9	Promote organizational image and mission		I			
Competency 6.0.6: Demonstrate positive relations in the workplace			I			
Competency Builders:						
6.0.6.1	Identify personality types of self and others		I			
6.0.6.2	Identify various management styles		I			
6.0.6.3	Support employer expectations		I			
6.0.6.4	Support employer decisions		I			
6.0.6.5	Accept constructive criticism		I			
6.0.6.6	Give constructive feedback		I			
6.0.6.7	Adapt to changes in work place		I			
6.0.6.8	List factors to consider before resigning		I			
6.0.6.9	Write letter of resignation		I			

Unit 6: Professionalism (cont.)		10	12	AD	WS	LL
Competency 6.0.7: Manage stressful situations			I			
Competency Builders:						
6.0.7.1	Accept stress as part of daily life		I			
6.0.7.2	Identify personal and professional factors contributing to stress		I			
6.0.7.3	Describe physical and emotional responses to stress		I			
6.0.7.4	Evaluate positive and negative effects of stress on productivity		I			
6.0.7.5	Identify strategies for reducing stress		I			
6.0.7.6	Implement strategies to manage stress		I			
6.0.7.7	Create strategies for developing and maintaining support systems		I			
Competency 6.0.8: Analyze effects of family on work and work on family		I	R			
Competency Builders:						
6.0.8.1	Identify how family values, goals, and priorities are reflected in work place	I	R			
6.0.8.2	Identify responsibilities and rewards associated with paid and non-paid work	I	R			
6.0.8.3	Identify responsibilities and rewards associated with families	I	R			
6.0.8.4	Explain how family responsibilities can conflict with work	I	R			
6.0.8.5	Explain how work can conflict with family responsibilities	I	R			
6.0.8.6	Explain how work-related stress can affect families	I	R			
6.0.8.7	Explain how family-related stress can affect work	I	R			
6.0.8.8	Identify family support systems and resources	I	R			
6.0.8.9	Identify work-related support systems and resources	I	R			
6.0.8.10	Communicate with family regarding work	I	R			

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Unit 6: Professionalism (cont.)	10	12	AD	WS	LL
Competency 6.0.9: Apply lifelong learning skills	I	R			
Competency Builders:					
6.0.9.1 Define lifelong learning	I	R			
6.0.9.2 Identify factors that cause need for lifelong learning	I	R			
6.0.9.3 Analyze effects of change	I	R			
6.0.9.4 Identify reasons why goals change	I	R			
6.0.9.5 Describe importance of flexibility and adaptability	I	R			
6.0.9.6 Evaluate need for continuing education/training	I	R			
Competency 6.0.10: Manage professional development		I			
Competency Builders:					
6.0.10.1 Identify career opportunities	I	R			
6.0.10.2 Modify career plan	I	R			
6.0.10.3 Participate in continuing education/training opportunities		I			
6.0.10.4 Document continuing education/training		I			
6.0.10.5 Read profession-related manuals, technical journals, and periodicals		I			
6.0.10.6 Participate in professional organizations		I			
6.0.10.7 Build personal/professional mentor relationship		I			
6.0.10.8 Build personal/professional support system		I			
6.0.10.9 Build professional network		I			
6.0.10.10 Strengthen communication skills		I			
6.0.10.11 Strengthen leadership skills		I			
6.0.10.12 Strengthen management skills		I			

Unit 7: Teamwork		10	12	AD	WS	LL
Competency 7.0.1: Demonstrate knowledge of teamwork		I	C			
Competency Builders:						
7.0.1.1	Define employee empowerment	I	C			
7.0.1.2	Differentiate work groups and teams	I	C			
7.0.1.3	Identify conditions essential to teamwork (e.g., brainstorming)	I	C			
7.0.1.4	Explain influence of culture (e.g., corporate, community) on teamwork	I	C			
7.0.1.5	Identify appropriate situations for using teams	I	C			
7.0.1.6	Define team structures (e.g., cross functional, quality improvement, task force, quality circles)	I	C			
7.0.1.7	Identify team building concepts	I	C			
7.0.1.8	Describe characteristics and dynamics of teams	I	C			
7.0.1.9	Identify characteristics of effective team leaders and members	I	C			
7.0.1.10	Identify responsibilities of a valuable team member	I	C			
7.0.1.11	Identify methods of involving each member of a team	I	C			
7.0.1.12	Explain how individuals from various backgrounds contribute to work-related situations (e.g., technical training, cultural heritage)	I	C			
7.0.1.13	Explain the purpose of facilitators	I	C			
7.0.1.14	Define consensus	I	C			
7.0.1.15	Define reward/recognition system	I	C			

Unit 7: Teamwork (cont.)		10	12	AD	WS	LL
Competency 7.0.2: Demonstrate teamwork		I	C			
Competency Builders:						
7.0.2.1	Identify purpose of team and intended goal (include time frames)	I	C			
7.0.2.2	Structure team around purpose	I	C			
7.0.2.3	Define responsibilities of team members	I	C			
7.0.2.4	Contribute to efficiency and success of team	I	C			
7.0.2.5	Work toward individual and team milestones	I	C			
7.0.2.6	Analyze results of team project	I	C			
7.0.2.7	Facilitate a team meeting	I	C			
7.0.2.8	Assist team member(s) with problem	I	C			
7.0.2.9	Monitor time frame	I	C			
7.0.2.10	Stress continuous improvement	I	C			
7.0.2.11	Accept failure as part of learning	I	C			
Competency 7.0.3: Use teamwork to solve problems		I				
Competency Builders:						
7.0.3.1	Identify appropriate situations for using teams	I	C			
7.0.3.2	Use problem-solving process in a team setting	I	C			
7.0.3.3	Identify quality management processes/techniques*					
7.0.3.4	Identify quality assurance processes/techniques*					
7.0.3.5	Prepare presentation	I	C			
*Need business clarification						

<i>Unit 7: Teamwork (cont.)</i>		10	12	AD	WS	LL
Competency 7.0.4: Conduct team meetings		I	R			
Competency Builders:						
7.0.4.1	Plan agenda	I	R			
7.0.4.2	Schedule meeting and location	I	R			
7.0.4.3	Invite appropriate personnel	I	R			
7.0.4.4	Solicit outside speakers as needed	I	R			
7.0.4.5	Assign someone to take minutes	I	R			
7.0.4.6	Facilitate introductions	I	R			
7.0.4.7	Invite questions and comments and group participation	I	R			
7.0.4.8	Focus team on agenda items	I	R			
7.0.4.9	Assign appropriate action, time frame and accountability to tasks	I	R			
7.0.4.10	Monitor time	I	R			
7.0.4.11	Close meeting on time	I	R			
7.0.4.12	Publish minutes in timely manner	I	R			
7.0.4.13	Set ground rules	I	R			
7.0.4.14	Avoid placing individual agendas above the group's agenda	I	R			

Unit 8: Quality Assurance		10	12	AD	WS	LL
Competency: 8.0.1 Demonstrate knowledge of quality assurance			I			
Competency Builders:						
8.0.1.1	Explain the ISO 9000 process		I			
8.0.1.2	Define quality terms		I			
8.0.1.3	Define quality functions		I			
8.0.1.4	Describe control devices used in functional areas (e.g., SPC, equipment)		I			
8.0.1.5	Explain the relationship among organizational structures, policies, procedures, and quality assurance		I			
8.0.1.6	Explain importance of internal and external customers		I	R		
8.0.1.7	Identify internal and external customers		I	R		
8.0.1.8	Describe successful efforts by industry to improve quality and/or reduce costs		I			
8.0.1.9	Differentiate prevention and detection		I			
Competency: 8.0.2 Demonstrate knowledge of engineering a quality product			I			
Competency Builders:						
8.0.2.1	Associate customer satisfaction with product characteristics (e.g., usefulness, price, operation, life, reliability, safety, cost of operation)		I			
8.0.2.2	Define failure		I			
8.0.2.3	Explain the role of testing and reliability		I			
8.0.2.4	Define value engineering		I			
8.0.2.5	Define quality objectives		I			
8.0.2.6	Identify cost components as they relate to quality objectives		I			

Unit 8: Quality Assurance (continued)		10	12	AD	WS	LL
Competency: 8.0.3 Demonstrate knowledge of quality cost implications			I			
Competency Builders:						
8.0.3.1	Identify cost/quality objectives		I			
8.0.3.2	Classify costs (i.e., direct and indirect, fixed and variable, methods and standards)		I			
8.0.3.3	Classify quality costs (i.e., prevention, evaluation, pre-delivery failure, post-delivery failure)		I			
8.0.3.4	Define product liability		I			
8.0.3.5	Explain consumerism and liability prevention		I			
8.0.3.6	Define safety terms of product		I			
8.0.3.7	Identify personal safety responsibility within organization		I			
8.0.3.8	Differentiate express and implied warranty		I			
Competency: 8.0.4 Explain importance of interdepartmental relationships to quality assurance			I			
Competency Builders:						
8.0.4.1	Explain need for everyone's commitment in assuring quality		I			
8.0.4.2	Explain phrase "Everyone is a customer/supplier"		I			
8.0.4.3	Define quality improvement team models		I			
8.0.4.4	Explain the importance of top management's support of quality		I			
8.0.4.5	Explain continuing improvement		I			

Unit 9: Technical Recording and Reporting	10	12	AD	WS	LL
Competency: 9.0.1 Demonstrate proficiency in technical recording	I	R	C		
Competency Builders:					
9.0.1.1 Describe various documentation procedures	I	R	C		
9.0.1.2 Interpret specifications or drawings	I	R	C		
9.0.1.3 Ask open-ended questions	I	R	C		
9.0.1.4 Record process (e.g., flowchart, step-by-step)	I	R	C		
9.0.1.5 Identify parameters	I	R	C		
9.0.1.6 Record accurate, truthful data	I	R	C		
9.0.1.7 Maintain test logs	I	R	C		
9.0.1.8 Compile cumulative reference notebook/record	I	R	C		
9.0.1.9 Measure appropriate parameters	I	R	C		
9.0.1.10 Draft preventive maintenance and calibration procedures	I	R	C		
Competency: 9.0.2 Demonstrate proficiency in technical reporting	I	I	C		
Competency Builders:					
9.0.2.1 Use data books and cross reference/technical manuals		I	C		√
9.0.2.2 Compose technical memoranda		I	C		
9.0.2.3 Identify type of report or format needed		I	C		
9.0.2.4 Use appropriate format	I	R	C		
9.0.2.5 Compile relevant data	I	R	C		
9.0.2.6 Design charts and graphs	I	R	C		
9.0.2.7 Analyze data	I	R	C		
9.0.2.8 Draw conclusions	I	R	C		
9.0.2.9 Explain analytical methods used		I	C		
9.0.2.10 Outline reports	I	R	C		
9.0.2.11 Write reports	I	R	C		
9.0.2.12 Present reports	I	R	C		

Unit 10: Computer Literacy	10	12	AD	WS	LL
Competency: 10.0.1 Describe personal computer operations		I	C		√
Competency Builders:					
10.0.1.1 Explain how data is stored in main computer memory		I	C		√
10.0.1.2 Explain how computer system executes program instruction		I	C		√
10.0.1.3 Explain computer storage capacity		I	C		√
10.0.1.4 Explain how data is represented		I	C		√
10.0.1.5 Describe data storage techniques		I	C		√
10.0.1.6 Identify types of memory		I	C		√
Competency: 10.0.2 Demonstrate basic use of computer operating system		C	R		
Competency Builders:					
10.0.2.1 Create ASCII text files with a text editor		C	R		
10.0.2.2 Explain rules for naming files and directories		C	R		
10.0.2.3 Manage files		C	R		
10.0.2.4 Create directories		C	R		
10.0.2.5 Remove directories		C	R		
10.0.2.6 Change directories		C	R		
10.0.2.7 Copy files		C	R		
10.0.2.8 Rename files		C	R		
10.0.2.9 Erase files		C	R		
10.0.2.10 Format diskettes		C	R		
10.0.2.11 Label diskettes		C	R		
10.0.2.12 Explain the syntax of operating system commands		C	R		
10.0.2.13 Use wildcards in operating system commands		C	R		

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Unit 10: Computer Literacy (cont.)	10	12	AD	WS	LL
Competency: 10.0.3 Explain information processing cycle		C	R		
Competency Builders:					
10.0.3.1 Differentiate operating systems (e.g., DOS, Windows, UNIX, MAC)		C	R		
10.0.3.2 Describe computer languages and their use		C	R		
10.0.3.3 Describe difference between data files and program files		C	R		
10.0.3.4 Identify PC hardware		C	R		
10.0.3.5 Explain Internet		C	R		
10.0.3.6 Explain PC network layout		C	R		
10.0.3.7 Explain mini/mainframe network layout		C	R		
10.0.3.8 Differentiate hardware and software		C	R		
10.0.3.9 Differentiate open from proprietary architecture		C	R		

Unit 10: Computer Literacy (cont.)	10	12	AD	WS	LL
Competency: 10.0.4 Use Software		I	C		
Competency Builders:					
10.0.4.1 Define software types and functions		C	R		
10.0.4.2 Describe basic disk operations and care		C	R		
10.0.4.3 Perform functions necessary to operate software		C	R		
10.0.4.4 List advantages and disadvantages of integrated and dedicated software		C	R		
10.0.4.5 Operate system software		C	R		
10.0.4.6 Explain diagnostic software		C	R		
10.0.4.7 Demonstrate basic proficiency in spreadsheet use		I	C		
10.0.4.8 Demonstrate basic proficiency in word processing		C	R		
10.0.4.9 Demonstrate basic proficiency in database use		I	C		
10.0.4.10 Demonstrate basic proficiency in network use		I	C		
10.0.4.11 Demonstrate basic proficiency of utility (e.g., WINDOWS, GUI)		I	C		
10.0.4.12 Demonstrate basic proficiency in report writing		I	C		
10.0.4.13 Demonstrate system commands		I	C		
10.0.4.14 Differentiate ethical use/misuse of software		I	C		
10.0.4.15 Describe bulletin boards/electronic mail		I	C		
10.0.4.16 Explain use and deletion of passwords		I	C		
Competency: 10.0.5 Operate computer hardware		C	R		
Competency Builders:					
10.0.5.1 Practice proper media handling techniques (e.g., magnetic fields, dust, liquids)		C	R		
10.0.5.2 Identify hardware and its use		C	R		
10.0.5.3 Use hardware (e.g, mouse, diskettes, drive, modems, touch screen, printers, digitizers, scanners, cables, protection devices)		C	R		
10.0.5.4 Demonstrate basic care of hardware		C	R		

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Unit 11: Workplace Safety		10	12	AD	WS	LL
Competency: 11.0.1 Apply general safety precautions			C	R		
Competency Builders:						
11.0.1.1	Identify local, state, and federal rules and regulations		C			
11.0.1.2	Identify personal protective wear and equipment		C	R		
11.0.1.3	Identify visual controls (e.g., monitors, read outs)		C	R		
11.0.1.4	Identify auditory controls		C	R		
11.0.1.5	Identify common sense housekeeping		C	R		
11.0.1.6	Interpret hazardous materials notices on containers		C			
11.0.1.7	Use personal protective wear and equipment		C	R		
11.0.1.8	Apply workplace safety rules and procedures		C	R		
11.0.1.9	Apply personal safety rule and procedures		C	R		
11.0.1.10	Apply workplace organization (e.g., housekeeping)		C	R		
11.0.1.11	Apply applicable electrical, mechanical, steam, hydraulic and pneumatic safety rules and procedures		C	R		
11.0.1.12	Apply fire safety rules and procedures		C	R		
11.0.1.13	Apply hazardous wastes rules and procedures		C			
11.0.1.14	Locate (MSDS)		C			
11.0.1.15	Perform lockout and tagout		C	R		
11.0.1.16	Recycle scrap metal, chips, shavings, coolants, solvents, trash, and waste materials		C			
11.0.1.17	Apply common sense housekeeping		C	R		
11.0.1.18	Use preventive maintenance checklists		C			
11.0.1.19	Explain basic philosophy of "right to know" legislation		C			

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Unit 11: Workplace Safety (cont)		10	12	AD	WS	LL
Competency: 11.0.2 Demonstrate knowledge of safety and workplace hazards			C	R		
Competency Builders:						
11.0.2.1	Describe corrective procedures for unsafe conditions		C	R		
11.0.2.2	Identify types and potential level of workplace hazards (e.g., physical hazards, fire, chemicals, noise, ionizing radiation, ultraviolet, temperature extremes, ergonomics, biological hazards)		C	R		
11.0.2.3	Identify safety materials/equipment (e.g., absorbent socks, oil dry)		C	R		
11.0.2.4	Interpret Material Safety Data Sheets (MSDS)		C	R		
11.0.2.5	Explain purpose(s) of OSHA and NIOSH		C	R		
11.0.2.6	Identify purpose of emergency evacuation routes, master switch and lockout locations, and safety color coding systems		C	R		
11.0.2.7	Describe methods of evaluating potential hazards (e.g., visual analysis)		C	R		
11.0.2.8	Describe methods of correcting potential hazards		C	R		
11.0.2.9	Identify need for reporting accidents		C	R		
11.0.2.10	Explain precautions required when using toxic or flammable materials		C	R		
11.0.2.11	Define confined space and related requirements		C	R		

Unit 12: Manual Drafting Technology		10	12	AD	WS	LL
Competency: 12.0.1 Apply basic drafting skills			C	R		
Competency Builders:						
12.0.1.1	Use drafting equipment, measuring scales, drawing media, drafting instruments and consumable materials, blueprint machine		C	R		
12.0.1.2	Identify line styles, weights (alphabet of lines)		C	R		
12.0.1.3	Select proper drawing scale, introduction to different types		C	R		
12.0.1.4	Prepare title blocks and other drafting formats		C	R		
12.0.1.5	Apply freehand and other lettering techniques		C	R		
12.0.1.6	Prepare multi-view drawings		C	R		
12.0.1.7	Prepare multi-view sketches		C	R		
12.0.1.8	Prepare orthographic views		C	R		
12.0.1.9	Measure angles		C	R		
12.0.1.10	Draw horizontal, vertical, angular, parallel, and perpendicular lines		C	R		
12.0.1.11	Transfer an angle		C	R		
12.0.1.12	Construct tangent lines (to arcs) and tangent arcs (to arcs)		C	R		
12.0.1.13	Bisect angles and arcs		C	R		
12.0.1.14	Bisect lines		C	R		
12.0.1.15	Divide lines		C	R		
12.0.1.16	Construct three-point circle		C	R		
12.0.1.17	Construct regular hexagon, pentagon, and octagon		C	R		
12.0.1.18	Prepare single-view drawings		C	R		
12.0.1.19	Prepare dimension drawings		C	R		
12.0.1.20	Interpret notes and dimensions to determine part		C	R		
12.0.1.21	Draw arcs, circles, and conics		C	R		
12.0.1.22	Transfer measurements		C	R		

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Unit 12: Manual Drafting Technology (cont)	10	12	AD	WS	LL
Competency: 12.0.2 Apply intermediate drafting skills		I	C		
Competency Builders:					
12.0.2.1 Apply isometric and perspective sketching techniques			C		
12.0.2.2 Prepare isometric and perspective sketches			C		
12.0.2.3 Prepare sectional views		C	R		
12.0.2.4 Prepare auxiliary views			C		
12.0.2.5 Identify ANSI symbols			C		
12.0.2.6 Prepare views of drilled and tapped holes, counterbores, countersinks		C	R		
12.0.2.7 Apply systems drafting techniques			C		
12.0.2.8 Identify a bill of materials		C	R		
12.0.2.9 Dimension drawings using ANSI Y14.5 standards			C		
12.0.2.10 Describe purpose of auxiliary and sectional views			C		
Competency: 12.0.3 Interpret basic prints		I	C		
Competency Builders:					
12.0.3.1 Visualize object from drawing		I	C		
12.0.3.2 Interpret orthographic projections		I	C		
12.0.3.3 Interpret isometric views		I	C		
12.0.3.4 Interpret sectional views		I	C		
12.0.3.5 Interpret detail and assembly drawings		I	C		
12.0.3.6 Interpret dimensions		I	C		
12.0.3.7 Interpret tolerances		I	C		
Competency: 12.0.4 Interpret intermediate prints		I	C		
Competency Builders:					
12.0.4.1 Interpret screw thread specifications		I	C		
12.0.4.2 Interpret pneumatic/hydraulic drawings			C		
12.0.4.3 Interpret schematics			C		

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Unit 12: Manual Drafting Technology (cont)	10	12	AD	WS	LL
Competency: 12.0.5 Interpret advanced prints		I	C		
Competency Builders:					
12.0.5.1 Interpret GD&T characteristic symbols		I	C		
12.0.5.2 Interpret GD&T supplementary symbols		I	C		
Competency: 12.0.6 Convert dimensions and tolerances		C	R		
Competency Builders:					
12.0.6.1 Convert dimensions and tolerances from English units to metric units		C	R		
12.0.6.2 Convert dimensions and tolerances from metric units to English units		C	R		
Competency: 12.0.7 Demonstrate dimensioning techniques		I	C		
Competency Builders:					
12.0.7.1 Construct arrowheads using various styles/disciplines		I	C		
12.0.7.2 Apply symbols for surface and texture control		I	C		
12.0.7.3 Add labels/notes to drawing		I	C		
12.0.7.4 Interpret decimal tolerance dimensions		C	R		
12.0.7.5 Dimension arcs		I	C		
12.0.7.6 Dimension angles		I	C		
12.0.7.7 Dimension curves		I	C		
12.0.7.8 Dimension rounded-end shapes		I	C		
12.0.7.9 Dimension spherical objects		I	C		
12.0.7.10 Dimension cylindrical objects		I	C		
12.0.7.11 Dimension cones, pyramids, and prisms			C		
12.0.7.12 Dimension features on circular center line		I	C		
12.0.7.13 Dimension theoretical point of intersection		I	C		
12.0.7.14 Dimension object using rectangular coordinate system			C		

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Unit 12: Manual Drafting Technology (cont)		10	12	AD	WS	LL
Competency: 12.0.8 Prepare mechanical drawings/sketches			I	C		
Competency Builders:						
12.0.8.1	Interpret basic mechanical standards and symbols		I	C		
12.0.8.2	Prepare drawings/sketches with special processed holes		I	C		
12.0.8.3	Prepare fastener drawings/sketches			C		

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Unit 13: Advanced Drafting Technology (with CADD)	10	12	AD	WS	LL
Competency: 13.0.1 Prepare advanced mechanical drawings			I		
Competency Builders:					
13.0.1.1 Prepare assembly drawings			C		
13.0.1.2 Prepare welding drawings			C		
13.0.1.3 Prepare cam drawings			I		
13.0.1.4 Prepare gear drawings			I		
13.0.1.5 Prepare pictorial drawings			C		
13.0.1.6 Interpret basic pneumatic/hydraulic standards and symbols			C		
13.0.1.7 Interpret various drawings (e.g., welding, casting, stamping, forging, civil, maps, pattern shop)			C		
13.0.1.8 Identify welding symbols		I	R		
13.0.1.9 Prepare symbol library			I		
Competency: 13.0.2 Apply revision control process			I		
Competency Builders:					
13.0.2.1 Apply drawing balloons			I		
13.0.2.2 Apply documentation (including project filing, back-up material, tracking process)			I		
13.0.1.3 Apply change control block			I		
13.0.1.4 Apply revision levels			I		

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Unit 14: CADD Fundamentals	10	12	AD	WS	LL
Competency: 14.0.1 Operate a CADD System		C	R		
Competency Builders:					
14.0.1.1 Execute CADD System		C	R		
14.0.1.2 Use keyboard input		C	R		
14.0.1.3 Use screen menus		C	R		
14.0.1.4 Use other input devices (e.g., scanner, digitizer)		C	R		
14.0.1.5 Create scaled plots		C	R		
14.0.1.6 Operate a pen plotter		C	R		
14.0.1.7 Operate a printer-plotter (i.e., laser plotter)		C	R		
14.0.1.8 Access on-line help for commands		C	R		
14.0.1.9 Use file conversion		C			
14.0.1.10 Use data transfer		C			
Competency: 14.0.2 Configure a CADD station		C	R		
Competency Builders:					
14.0.2.1 Configure display drivers		C	R		
14.0.2.2 Configure printer/plotter drivers		C	R		
14.0.2.3 Configure input drivers		C	R		
Competency: 14.0.3 Select entities for action		C	R		
Competency Builders:					
14.0.3.1 Add or remove entities separately		C	R		
14.0.3.2 Add or remove entities using a window		C	R		
14.0.3.3 Add or remove entities with a crossing-box		C	R		
14.0.3.4 Select entities using a fence		C	R		
14.0.3.5 Select entities by other methods (e.g., last, previous, type, all, etc.)		C	R		

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Unit 14: CADD Fundamentals (cont.)	10	12	AD	WS	LL
Competency: 14.0.4 Create 2-D orthographic drawings		C	R		
Competency Builders:					
14.0.4.1 Create primitive drawing entities		C	R		
14.0.4.2 Create accurate geometry		C	R		
14.0.4.3 Draw utilizing absolute Cartesian coordinates		C	R		
14.0.4.4 Draw utilizing relative Cartesian coordinates		C	R		
14.0.4.5 Draw utilizing polar coordinates		C	R		
14.0.4.6 Draw using construction aids (e.g., snaps, grid, snap, etc.)		C	R		
14.0.4.7 Change drawing attributes		C	R		
14.0.4.8 Edit drawing entity properties (e.g., color, layer, thickness, linetype)		C	R		
14.0.4.9 Construct drawing entities (e.g., offset, trim, extend, break, mirror, etc.)		C	R		
14.0.4.10 Edit drawing entities (e.g., offset, trim, extend, break, mirror, etc.)		C	R		
14.0.4.11 Set system variables (e.g., units, scale)		C	R		
14.0.4.12 Use system variables		C	R		
14.0.4.13 Create layers		C	R		
14.0.4.14 Name layers		C	R		
14.0.4.15 Manipulate layers		C	R		
14.0.4.16 Save files		C	R		
14.0.4.17 Create back-ups		C	R		
14.0.4.18 Create hatches, patterns, symbols		C	R		
14.0.4.19 Recall drawing templates/blocks		C	R		
Competency: 14.0.5 Annotate orthographic drawings		C	R		
Competency Builders:					
14.0.5.1 Create text styles		C	R		
14.0.5.2 Edit text styles		C	R		
14.0.5.3 Select text styles		C	R		
14.0.5.4 Apply notes		C	R		

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Unit 14: CADD Fundamentals (cont.)	10	12	AD	WS	LL
Competency: 14.0.6 Dimension orthographic drawings		C	R		
Competency Builders:					
14.0.6.1 Create dimensions		C	R		
14.0.6.2 Edit text		C	R		
14.0.6.3 Control dimension variables/models		C	R		
Competency: 14.0.7 Control display		C	R		
Competency Builders:					
14.0.7.1 Apply view control while drawing (e.g., zoom and pan)		C	R		
14.0.7.2 Control view resolution		C	R		
14.0.7.3 Save views		C	R		
14.0.7.4 Display views		C	R		
Competency: 14.0.8 Extract entity and drawing information		C	R		
Competency Builders:					
14.0.8.1 Measure distances		C	R		
14.0.8.2 Measure areas		C	R		
14.0.8.3 Identify locations		C	R		
14.0.8.4 List entity characteristics (e.g., length, size, location, properties, etc.)		C	R		

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Unit 15: Intermediate CADD	10	12	AD	WS	LL
Competency: 15.0.1 Manage symbols and attributes		I	C		
Competency Builders:					
15.0.1.1 Create blocks and W-blocks/templates		I	C		
15.0.1.2 Create nested blocks/templates			C		
15.0.1.3 Insert blocks and drawings/templates		I	C		
15.0.1.4 Redefine blocks/templates			C		
15.0.1.5 Edit blocks/templates			C		
Competency: 15.0.2 Create 2-D isometric drawings		I	C		
Competency Builders:					
15.0.2.1 Manipulate snap and grid settings		C	R		
15.0.2.2 Create text styles for each plane			C		
15.0.2.3 Create dimension styles		I	C		
15.0.2.4 Use dimension styles		I	C		
Competency: 15.0.3 Create custom linetypes		I			
Competency Builders:					
15.0.3.1 Formulate a linetype composed of long dashes		I			
15.0.3.2 Formulate a linetype composed of lines, dashes, and dots		I			
Competency: 15.0.4 Create 3-D wireframe models			C		
Competency Builders:					
15.0.4.1 Differentiate among extrusions, wireframes, surface models, and solid models			C		
15.0.4.2 Create user coordinate systems			C		
15.0.4.3 Manipulate user coordinate systems			C		
15.0.4.4 Project geometry from one plane to another			C		

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Unit 16: Advanced CADD	10	12	AD	WS	LL
Competency: 16.0.1 Constrain a sketch			C		
Competency Builders:					
16.0.1.1 Delete constraints			C		
16.0.1.2 Add constraints			C		
16.0.1.3 Add dimensions to sketch			C		
16.0.1.4 Change dimensions on sketch			C		
16.0.1.5 Relate dimensions with equations			C		
16.0.1.6 Use global parameters			C		
Competency: 16.0.2 Create a parametric solid model			C		
Competency Builders:					
16.0.2.1 Edit global parameters			C		
16.0.2.2 Constrain a sketch			C		
16.0.2.3 Define work planes, points, and axes			C		
16.0.2.4 Define sketch planes			C		
16.0.2.5 Create solid primitives			C		
16.0.2.6 Modify solid primitives			C		
16.0.2.7 Create swept solids			C		
16.0.2.8 Use Boolean operations to create complex solids (e.g., unions, subtractions, intersections, separations)			C		
16.0.2.9 Fillet solid models			C		
16.0.2.10 Chamfer solid models			C		
16.0.2.11 Extract mass properties from a solid model			C		
16.0.2.12 Create 2-D profiles and sections from a solid model			C		
16.0.2.13 Explain the advantages/limitations of solid modeling			C		
16.0.2.14 Extrude a profile			C		
16.0.2.15 Create revolutions			C		
16.0.2.16 Add hole features			C		

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Unit 16: Advanced CADD (cont.)	10	12	AD	WS	LL
Competency: 16.0.3 Create a parametric solid assembly			C		
Competency Builders:					
16.0.3.1 Import parts			C		
16.0.3.2 Export parts			C		
Competency: 16.0.4 Create a drawing from a parametric solid			C		
Competency Builders:					
16.0.4.1 Define base view			C		
16.0.4.2 Define orthographic views using base views			C		
16.0.4.3 Define isometric view			C		
16.0.4.4 Define auxillary views			C		
16.0.4.5 Define section views			C		
16.0.4.6 Define detail views			C		
Competency: 16.0.5 Dimension a parametric solid drawing			C		
Competency Builders:					
16.0.5.1 Move dimensions			C		
16.0.5.2 Add reference dimensions			C		
16.0.5.3 Freeze and thaw dimensions			C		
16.0.5.4 Define dimension styles and attributes			C		
16.0.5.5 Change dimension styles and attributes			C		
16.0.5.6 Add hole notes			C		
16.0.5.7 Add other annotations			C		
Competency: 16.0.6 Apply advanced display control			I		
Competency Builders:					
16.0.6.1 Use clipping planes to section a model			C		
16.0.6.2 Create rendered images of surface and solid models			I		

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Unit 17: Precision Machining	10	12	AD	WS	LL
Competency: 17.0.1 Perform prerequisite machining skills		I	C		
Competency Builders:					
17.0.1.1 Demonstrate maintenance of immediate work area, machinery, tools and gages		I	C		
17.0.1.2 Demonstrate proficiency in interpreting prints/drawings		I	C		
17.0.1.3 Demonstrate proficiency in planning work sequence/set up		I	C		
17.0.1.4 Follow safety rules and regulations for each machine		C	R		
Competency 17.0.2 Analyze machine shop jobs		I	C		
Competency Builders:					
17.0.2.1 Identify sequence of work on specified project(s)		I	C		
17.0.2.2 Identify tolerances and surface finishes on specified project(s)		I	C		
17.0.2.3 Identify variables that affect efficiency (e.g., speeds, feeds)		I	C		
17.0.2.4 Use Machinery Handbook		I	C		
17.0.2.5 Identify causes of workpiece defects		I	C		
Competency 17.0.3 Perform bench operations		I	R		
Competency Builders:					
17.0.3.1 Use measuring instruments and hand tools		I	R		
17.0.3.2 Deburr workpiece		I	R		
17.0.3.3 Lay out workpiece		I	R		
17.0.3.4 Drill hole		I	R		
17.0.3.5 Hand tap hole		I	R		
17.0.3.6 Cut threads with die		I	R		
17.0.3.7 Apply basic metallurgy knowledge		I	R		

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Unit 17: Precision Machining (cont.)	10	12	AD	WS	LL
Competency 17.0.4 Operate metal cutting saw		I	R		
Competency Builders:					
17.0.4.1 Identify types and uses		I	C		
17.0.4.2 Transfer dimensions from blueprint		I	C		
17.0.4.3 Clean metal cutting saw		I			
17.0.4.4 Lubricate metal cutting saw		I			
17.0.4.5 Install guides		I	R		
17.0.4.6 Adjust guides		I	R		
17.0.4.7 Select proper blades		I			
17.0.4.8 Install saw blade		I			
17.0.4.9 Select speeds and feeds		I			
17.0.4.10 Cut metal		I	R		
17.0.4.11 Deburr workpiece		I	R		
17.0.4.12 Apply basic metallurgy knowledge		I	R		
17.0.4.13 Identify proper cutting fluids		I	R		
Competency 17.0.5 Operate drill press		I	R		
Competency Builders:					
17.0.5.1 Clean drill press		I			
17.0.5.2 Lubricate drill press		I			
17.0.5.3 Identify proper cutting fluid		I			
17.0.5.4 Mount part		I	R		
17.0.5.5 Select proper bit, speed and feed		I	C		
17.0.5.6 Demonstrate proper bit sharpening techniques		I			
17.0.5.7 Drill part		I	R		
17.0.5.8 Countersink		I	R		
17.0.5.9 Tap hole		I	R		
17.0.5.10 Apply basic metallurgy knowledge		I	R		

Unit 17: Precision Machining (cont.)	10	12	AD	WS	LL
Competency 17.0.6 Operate pedestal grinder		I			
Competency Builders:					
17.0.6.1 Clean pedestal grinder		I			
17.0.6.2 Lubricate pedestal grinder		I			
17.0.6.3 Identify proper wheel		I			
17.0.6.4 Identify proper coolant		I			
17.0.6.5 Check wheel for defects		I			
17.0.6.6 Mount wheel		I			
17.0.6.7 Position guard and rest		I			
17.0.6.8 Dress wheel		I			
17.0.6.9 Sharpen drill bit		I			
17.0.6.10 Apply basic metallurgy knowledge		I			
Competency 17.0.7 Operate surface grinder		I	R		
Competency Builders:					
17.0.7.1. Clean surface grinder		I			
17.0.7.2 Lubricate surface grinder		I			
17.0.7.3 Identify proper cutting fluid		I			
17.0.7.4 Select proper wheel		I	R		
17.0.7.5 Select proper speeds and feeds		I	R		
17.0.7.6 Check wheel for defects		I	R		
17.0.7.7 Install wheel		I			
17.0.7.8 Position guard		I	R		
17.0.7.9 Dress wheel		I	R		
17.0.7.10 Identify proper holding/fixtures methods		I	R		
17.0.7.11 Load workpiece		I	R		
17.0.7.12 Set surface grinder		I	R		
17.0.7.13 Apply basic metallurgy knowledge		I	R		

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Unit 17: Precision Machining (cont.)	10	12	AD	WS	LL
Competency 17.0.8 Operate Lathe		I	R	√	
Competency Builders:					
17.0.8.1 Clean lathe		I	R	√	
17.0.8.2 Lubricate lathe		I		√	
17.0.8.3 Deburr		I	R	√	
17.0.8.4 Demonstrate use of a 4-jaw chuck		I		√	
17.0.8.5 Identify proper cutting fluid		I	R	√	
17.0.8.6 Identify proper tools and holders		I	R	√	
17.0.8.7 Sharpen tools properly		I		√	
17.0.8.8 Mount workpiece		I	R	√	
17.0.8.9 Use dial indicator		I	R	√	
17.0.8.10 Position guards		I	R	√	
17.0.8.11 Select feed(s) and speed(s)		I	C	√	
17.0.8.12 Face workpiece		I	R	√	
17.0.8.13 Turn shaft		I	R	√	
17.0.8.14 Turn taper		I		√	
17.0.8.15 Knurl workpiece		I		√	
17.0.8.16 Cut off workpiece		I	R	√	
17.0.8.17 Center drill hole		I	R	√	
17.0.8.18 Cut threads (inside and outside)		I	R	√	
17.0.8.19 Turn inside bore		I	R	√	
17.0.8.20 Demonstrate use of steady rest		I		√	
17.0.8.21 Demonstrate use of centers		I	R	√	
17.0.8.22 Apply basic metallurgy knowledge		I	R	√	

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Unit 17: Precision Machining (cont.)	10	12	AD	WS	LL
Competency 17.0.9 Operate milling machine		I	R		
Competency Builders:					
17.0.9.1 Clean milling machine		I			
17.0.9.2 Lubricate milling machine		I			
17.0.9.3 Identify proper cutting fluid		I			
17.0.9.4 Select proper tool		I	R		
17.0.9.5 Select proper surface feet per minute		I	C		
17.0.9.6 Calculate proper feeds and speeds		I	C		
17.0.9.7 Type of cut (e.g., climb, std.)		I	C		
17.0.9.8 Mount workpiece		I	R		
17.0.9.9 Mount tool		I	R		
17.0.9.10 Mill surface		I	R		
17.0.9.11 Mill keyway		I	R		
17.0.9.12 Drill workpiece		I	R		
17.0.9.13 Bore with milling machine		I			
17.0.9.14 Mill angle		I	R		
17.0.9.15 Apply basic metallurgy knowledge		I	R		
Competency 17.0.10 Select materials		I	R		
Competency Builders:					
17.0.10.1 Interpret color codes, numbering systems, and classification systems of materials (i.e., ANSI, SAE)		I	R		
17.0.10.2 Identify metals using spark test		I			
17.0.10.3 Identify metals using variety of tests		I	C		
17.0.10.4 Identify materials		I	C		
17.0.10.5 Apply basic metallurgy knowledge		I	R		

Unit 17: Precision Machining (cont.)	10	12	AD	WS	LL
Competency 17.0.11 Demonstrate knowledge of heat treatment		I	C		
Competency Builders:					
17.0.11.1 Harden metals		I	C		
17.0.11.2 Temper metals		I	C		
17.0.11.3 Anneal metals		I	C		
17.0.11.4 Normalize metals		I	C		
17.0.11.5 Explain case hardening metals		I	C		
Competency 17.0.12 Perform testing of metals			C		
Competency Builders:					
17.0.12.1 Test hardness of metals		I	C		
17.0.12.2 Explain non-destructive testing methods			C		
17.0.12.3 Perform destructive testing			C		

Unit 17: Precision Machining (cont.)		10	12	AD	WS	LL
Competency 17.0.13 Explain nontraditional machining processes			I	C	√	√
Competency Builders:						
17.0.13.1	Describe principles of chemical etching		I	C	√	√
17.0.13.2	List applications of chemical etching		I	C	√	√
17.0.13.3	List advantages/disadvantages of chemical etching		I	C	√	√
17.0.13.4	Describe principles of photochemical etching		I	C	√	√
17.0.13.5	List applications of photochemical etching		I	C	√	√
17.0.13.6	List advantages/disadvantages of photochemical etching		I	C	√	√
17.0.13.7	Describe electrical-discharge machining (EDM)		I	C	√	√
17.0.13.8	List applications of EDM		I	C	√	√
17.0.13.9	Differentiate between EDM and wire EDM		I	C	√	√
17.0.13.10	List applications for wire EDM		I	C	√	√
17.0.13.11	Describe principles of electrochemical machining			C	√	√
17.0.13.12	List applications of electrochemical machining			C	√	√
17.0.13.13	List advantages/disadvantages of electrochemical machining			C	√	√
17.0.13.14	Describe principles of water jet cutting			C	√	√
17.0.13.15	List applications of water jet cutting			C	√	√
17.0.13.16	Describe principles of torch cutting		I	C	√	√
17.0.13.17	List applications of torch cutting		I	C	√	√
17.0.13.18	Describe principles of laser cutting			C	√	√
17.0.13.19	List applications of laser cutting			C	√	√
17.0.13.20	List advantages/disadvantages of laser cutting			C	√	√
17.0.13.21	Describe shot peen			C	√	√
17.0.13.22	Describe media finish			C	√	√
17.0.13.23	Describe glass bead			C	√	√
17.0.13.24	Describe principles of laser welding			C	√	√

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Unit 17: Precision Machining (cont.)		10	12	AD	WS	LL
Competency 17.0.14 Perform precision layouts			I	C		
Competency Builders:						
17.0.14.1	Identify appropriate tools for measuring		I	C		
17.0.14.2	Describe precision, accuracy, tolerance, reliability, and discrimination		I	C		
17.0.14.3	Distinguish between precision and semiprecision measuring		I	C		
17.0.14.4	Define standard stock dimensions and tolerances		I	C		
17.0.14.5	Demonstrate knowledge of different units of measure (metric, standard, inches, etc.)		I	C		
17.0.14.6	Describe common measurement errors and correction procedures		I	C		
17.0.14.7	Calibrate measuring machines and devices		I	C		
17.0.14.8	Demonstrate care of measuring instruments		I	C		
17.0.14.9	Demonstrate use of rule		I	C		
17.0.14.10	Demonstrate use of tape		I	C		
17.0.14.11	Demonstrate use of combination square		I	C		
17.0.14.12	Demonstrate use of calipers		I	C		
17.0.14.13	Demonstrate use of micrometers (inside and out)		I	C		
17.0.14.14	Demonstrate use of dial indicators		I	C		
17.0.14.15	Demonstrate use of sine bar		I	C		
17.0.14.16	Demonstrate use of gauges (e.g., dial bore, dial snaps)		I	C		
17.0.14.17	Demonstrate use of surface plate		I	C		
17.0.14.18	Demonstrate use of protractor head		I	C		
17.0.14.19	Explain use of profilometer to determine surface finish		I	C		
17.0.14.20	Demonstrate use of thermometer (for ambient conditions)		I	C		
17.0.14.21	Demonstrate use of dividers		I	C		
17.0.14.22	Demonstrate basic use of gauge blocks		I	C		
17.0.14.23	Demonstrate use of threading specs		I	C		

Unit 17: Precision Machining (cont.)	10	12	AD	WS	LL
Competency 17.0.14 Perform precision layouts (cont.)					
Competency Builders:					
17.0.14.24 Explain use of optical comparitor		I	C		
17.0.14.25 Explain use of digital instruments		I	C		
17.0.14.26 Explain use of electronic gauging equipment		I	C		
17.0.14.27 Explain use of data acquisition equipment		I	C		
17.0.14.28 Explain operation of manual coordinate measuring machine (CMM)		I	C		
17.0.14.29 Explain use and application of laser alignment/measurement		I	C		
Competency 17.0.15 Perform basic physical layouts		I	C		
Competency Builders:					
17.0.15.1 Use inside diameter (ID), outside diameter (OD), and hermaphrodite calipers		I	C		
17.0.15.2 Lay out with combination square		I	C		
17.0.15.3 Lay out with scribe, divider and trammel		I	C		
17.0.15.4 Use surface plate		I	C		
17.0.15.5 Use surface gage		I	C		
17.0.15.6 Use layout fluid		I	C		
17.0.15.7 Use V-blocks		I	C		
17.0.15.8 Use clamps		I	C		
17.0.15.9 Use angle plate		I	C		
17.0.15.10 Use parallels		I	C		
17.0.15.11 Use punches		I	C		
17.0.15.12 Use transfer method tools		I	C		
17.0.15.13 Use layout hammer		I	C		
17.0.15.14 Use machinist's square		I	C		
17.0.15.15 Use universal bevel protractor		I	C		
17.0.15.16 Use machinist's scale		I	C		

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Unit 18: Manufacturing Technology		10	12	AD	WS	LL
Competency 18.0.1 Describe industrial manufacturing process			I	C		
Competency Builders:						
18.0.1.1	Develop flow chart and process sheets		I	C		
18.0.1.2	Explain need for manufacturing documentation (e.g., ISO 9000)		I	C		
18.0.1.3	Define quality process		I	C		
Competency 18.0.2 Demonstrate knowledge of materials requirements planning			I	C		
Competency Builders:						
18.0.2.1	Define materials requirements planning		I	C		
18.0.2.2	Explain importance of maintaining and controlling inventory (e.g., quantity, price, quality, minimal lot sizes, and timeliness)		I	C		
18.0.2.3	Define master production schedule and bill of materials		I	C		
18.0.2.4	Explain inventory carrying cost and economic order quantity		I	C		
18.0.2.5	Describe the use of the computer in MRP		I	C		
18.0.2.6	Calculate net requirements		I	C		
Competency 18.0.3 Demonstrate knowledge of supply materials			I	C		
Competency Builders:						
18.0.3.1	Describe role of purchase requisitions		I	C		
18.0.3.2	Describe role of material specifications		I	C		
18.0.3.3	Describe role of quality parameters		I	C		
18.0.3.4	Define supplier certification rating methods		I	C		
18.0.3.5	Describe role of source inspector		I	C		
18.0.3.6	Describe role of receiving		I	C		

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Unit 18: Manufacturing Technology (cont)		10	12	AD	WS	LL
Competency 18.0.4 Demonstrate knowledge of plant layouts			I	C		
Competency Builders:						
18.0.4.1	Describe the importance of flexibility		I	C		
18.0.4.2	Differentiate among product layout, process layout, fixed position layout, and cellular layout		I	C		
18.0.4.3	Describe the type of production suited to each layout		I	C		
18.0.4.4	Describe advantages and disadvantages of each layout		I	C		
Competency 18.0.5 Demonstrate knowledge of material flow			I	C		
Competency Builders:						
18.0.5.1	Describe importance of flexibility		I	C		
18.0.5.2	Differentiate straight-line, U-shaped, S-shaped, convoluted and comb patterns		I	C		
18.0.5.3	Describe advantages and disadvantages of each pattern		I	C		
Competency 18.0.6 Demonstrate knowledge of pre- and post-production control				C		
Competency Builders:						
18.0.6.1	Explain importance of product protection, identification and storage			C		
18.0.6.2	Describe methods of identifying products (e.g., labels, bar codes, radio frequency systems and magnetic strip systems)			C		
18.0.6.3	Describe manual methods of storage and retrieval			C		
18.0.6.4	Describe automated storage and retrieval systems (ASRS)			C		
18.0.6.5	Describe automated guided vehicle moving systems (AGVS)			C		
18.0.6.6	List the types and advantages of available AGVS			C		

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Unit 18: Manufacturing Technology (cont)		10	12	AD	WS	LL
Competency 18.0.7 Demonstrate knowledge of various advanced manufacturing technologies				C		
Competency Builders:						
18.0.7.1	Explain the major defining and functional characteristics of Automated Assembly			C		
18.0.7.2	Demonstrate knowledge of the principles and product design features of Automated Assembly by determining the suitability of a product candidate for Automated Assembly			C		
18.0.7.3	Explain the major defining and functional characteristics of Group Technology			C		
18.0.7.4	Demonstrate an understanding of Group Technology principles in coding products using one of the standard coding systems			C		
18.0.7.5	Explain the major defining and functional characteristics of Simulation			C		
18.0.7.6	Explain where Simulation can be used appropriately as a tool in today's manufacturing systems			C		
18.0.7.7	Explain the major defining and functional characteristics of Lasers		I	C		
18.0.7.8	Explain the major defining and functional characteristics of the principles of Automation			C		
18.0.7.9	Perform discrete part manufacture break-even analysis and economic lot size calculations to determine the appropriate type of manufacturing process			C		
18.0.7.10	Explain the major defining and functional characteristics of Flexible Manufacturing Cells and Flexible Manufacturing Systems		I	C		
18.0.7.11	Perform "what-if" computerized analysis of the changes in lot size, equipment, and manpower on the performance of flexible manufacturing cells and systems			C		
18.0.7.12	Explain the major defining and functional characteristics of Computer Integrated Manufacturing			C		

Unit 18: Manufacturing Technology (cont)		10	12	AD	WS	LL
Competency 18.0.8 Apply robot fundamentals				C		
Competency Builders:						
18.0.8.1	Describe the operation of robotic work cells		I	C		
18.0.8.2	Operate a robot single tasking			C		
18.0.8.3	Troubleshoot robotic functions			C		
18.0.8.4	Classify robots according to industry criteria			C		
18.0.8.5	Identify robot power drive types			C		
18.0.8.6	Describe positioning in terms of axis, actuators, and coordinate system			C		
18.0.8.7	Identify types of control systems and sensors			C		
18.0.8.8	Apply different methods of programming (e.g., teach, off-line)			C		
18.0.8.9	Write simple programs to exercise robot functions			C		
18.0.8.10	Identify principles of robot safety			C		
18.0.8.11	Describe operation of various sensors used in robot control			C		
18.0.8.12	Interface sensors to robot			C		
18.0.8.13	Define open loop and closed loop control			C		
18.0.8.14	Design a simple automated system to perform manufacturing operation			C		
18.0.8.15	Identify operation of end-effectors			C		
Competency 18.0.9 Analyze a manufacturing project			I	C		
Competency Builders:						
18.0.9.1	Explain the "how" of project selection		I	C		
18.0.9.2	Explain the "how" of project implementation		I	C		
18.0.9.3	Explain the "how" of project evaluation		I	C		
18.0.9.4	Explain the "how" of planning continuing improvement		I	C		

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Unit 18: Manufacturing Technology (cont)		10	12	AD	WS	LL
Competency 18.0.10 Manufacture a new or existing product using all aspects of the total manufacturing cycle			I	C		
Competency Builders:						
18.0.10.1	Evaluate product to be manufactured		I	C		
18.0.10.2	Do reverse assembly, if existing product			C		
18.0.10.3	Prepare process sheets/set-up sheets		I	C		
18.0.10.4	Make parts drawings and bill-of-material		I	C		
18.0.10.5	Analyze individual components or sub-assemblies for possible material, design, or process change to reduce cost or to meet any performance, dimensional, or quality requirements		I	C		
18.0.10.6	Demonstrate teamwork skills		I	C		
18.0.10.7	Finalize purchased components and services, including establishing lead times and costs		I	C		
18.0.10.8	Place orders for just-in-time delivery and for raw materials for in-house manufacture		I	C		
18.0.10.9	Manufacture in-house components		I	C		
18.0.10.10	Inspect in-house manufactured components		I	C		
18.0.10.11	Inspect purchased components as received		I	C		
18.0.10.12	Assemble product, including inspection and testing		I	C		
18.0.10.13	Finish product		I	C		
18.0.10.14	Package product		I	C		
18.0.10.15	Prepare product for shipping		I	C		
18.0.10.16	Determine total cost of manufacture of the product		I	C		

Unit 19: Computerized Numerical Control (CNC)		10	12	AD	WS	LL
Competency 19.0.1 Demonstrate knowledge of CNC			I	C		
Competency Builders:						
19.0.1.1	Define computerized numerical control (CNC)		I	C		
19.0.1.2	Describe closed loop, open loop, and adaptive controls		I	C		
19.0.1.3	Identify data input mediums		I	C		√
19.0.1.4	Explain the purpose of the post-processor		I	C		
19.0.1.5	Define canned cycles		I	C		
19.0.1.6	Identify computer memory types		I	C		
19.0.1.7	Differentiate hardware and software		I	C		
19.0.1.8	Differentiate among CNC, machining centers, and robots		I	C		
19.0.1.9	List advantages/disadvantages of CNC machining centers		I	C		
19.0.1.10	Explain direct numerical control (DNC)		I	C		
19.0.1.11	Apply basic G-code programming (i.e., milling, turning, simple geometrics)		I	C		
19.0.1.12	Determine if CNC is economically beneficial to manufacture a specific part		I	C		
19.0.1.13	Explain the role of CNC in the evolution of manufacturing		I	C		
Competency 19.0.2 Set up CNC machining center			C	R		
Competency Builders:						
19.0.2.1	Load program from MDI and off-line programming station		C	R		
19.0.2.2	Prepare work-holding device		C	R		
19.0.2.3	Mount work-holding device		C	R		
19.0.2.4	Secure workpiece		C	R		
19.0.2.5	Set up reference and clearance points		C	R		
19.0.2.6	Set up tooling/automated tool changer		C	R		
19.0.2.7	Select proper lubrication/coolant		C	R		

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Unit 19: Computerized Numerical Control (cont)		10	12	AD	WS	LL
Competency 19.0.3 Set up CNC turning center			C	R		
Competency Builders:						
19.0.3.1	Load program from MDI and off-line programming station		C	R		
19.0.3.2	Prepare work-holding device		C	R		
19.0.3.3	Mount work-holding device		C	R		
19.0.3.4	Secure workpiece		C	R		
19.0.3.5	Set up reference and clearance points		C	R		
19.0.3.6	Set up tooling/automated tool changer		C	R		
19.0.3.7	Select proper lubrication/coolant		C	R		
Competency 19.0.4 Operate CNC machining center			C	R		
Competency Builders:						
19.0.4.1	Load raw material		C	R		
19.0.4.2	Start cycle		C	R		
19.0.4.3	Monitor work in-process		C	R		
19.0.4.4	Edit CNC programs		C	R		
19.0.4.5	Demonstrate ability to halt running program		C	R		
19.0.4.6	Apply proper safety procedures		C	R		
19.0.4.7	Demonstrate proper cleaning of CNC machine		C	R		
19.0.4.8	Apply tool offsets		C	R		

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Unit 19: Computerized Numerical Control (cont)		10	12	AD	WS	LL
Competency 19.0.5 Operate CNC turning center			C	R		
Competency Builders:						
19.0.5.1	Load raw material		C	R		
19.0.5.2	Start cycle		C	R		
19.0.5.3	Monitor work in-process		C	R		
19.0.5.4	Edit CNC programs		C	R		
19.0.5.5	Demonstrate ability to halt running program		C	R		
19.0.5.6	Apply proper safety procedures		C	R		
19.0.5.7	Demonstrate proper cleaning of CNC machine		C	R		
19.0.5.8	Apply tool offsets		C	R		
Competency 19.0.6 Manufacture workpiece (e.g., rectangular, round, angular)			C	R		
Competency Builders:						
19.0.6.1	Dry-run machine		C	R		
19.0.6.2	Run part		C	R		
19.0.6.3	Inspect part		C	R		
Competency 19.0.7 Apply CNC operations			I	C		
Competency Builders:						
19.0.7.1	Identify parts of the machine		I	C		
19.0.7.2	Apply basic programming skills to a turning and a milling operation		I	C		
19.0.7.3	Select proper work holders		I	C		
19.0.7.4	Select proper cutting tools		I	C		
19.0.7.5	Use CAD/CAM for part program development		I	C		
19.0.7.6	Set proper cutting tool offsets		I	C		

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Unit 19: Computerized Numerical Control (cont)		10	12	AD	WS	LL
Competency 19.0.8 Prepare CNC program			I	C		√
Competency Builders:						
19.0.8.1	Write a program manually in word address format		I	C		√
19.0.8.2	Write a program off line		I	C		√
19.0.8.3	Write a program manually in conversational program		I	C		√
19.0.8.4	Generate a program using CAD/CAM package		I	C		√
19.0.8.5	Program machine using manual data input (MDI) process		I	C		√
Competency 19.0.9 Program CNC operations			I	R		√
Competency Builders:						
19.0.9.1	Apply ANSI drawing standards		I	C		√
19.0.9.2	Apply process planning from drawing to finished product		I	C		√
19.0.9.3	Analyze workpiece		I	C		√
19.0.9.4	Perform basic trigonometric computations		C	R		√
19.0.9.5	Perform cutter compensation computations		I	C		√
19.0.9.6	Set chip load, feed rates and surface feet per minute limitations		I	C		√
19.0.9.7	Turn intersection points into segments (i.e., defined in terms of points, lines, and circles)		I	C		√
19.0.9.8	Debug program		I	R		√

Unit 20: Basic Materials Science		10	12	AD	WS	LL
Competency 20.0.1 Demonstrate basic knowledge of materials science			I	C		
Competency Builders:						
20.0.1.1	Define metallurgy		I	C		
20.0.1.2	Define metal forming (e.g., general process)		I	C		
20.0.1.3	Identify forming industries (e.g., stamping, forging, fabricating)		I	C		
20.0.1.4	Describe metal forming principles		I	C		
20.0.1.5	Describe the metal forming process		I	C		√
20.0.1.6	Identify frequently used metals		C	R		
20.0.1.7	Describe the crystalline structures of metals		I	C		
20.0.1.8	List common chemical properties of metals (i.e., corrosion)	I	R	C		
20.0.1.9	List common physical properties of metals (i.e., heat, electrical conductivity)	I	R	C		
20.0.1.10	Describe measures of metal strength		I	C		
20.0.1.11	Identify examples of raw materials processed by hot rolling, cold rolling, forging, drawing, extrusion, spinning and powered metallurgy		I	C		
20.0.1.12	Explain secondary finishing operations (e.g., paint, anodizing)		I	C		
Competency 20.0.2 Demonstrate basic knowledge of heat treatment			I	C		√
Competency Builders:						
20.0.2.1	Describe process of heat treating		I	C		√
20.0.2.2	Define types of heat treating (e.g., case hardening, annealing, drawing, stress relieving, tempering, quenching, critical temperature)		I	C		√

Unit 20: Basic Materials Science (cont)		10	12	AD	WS	LL
Competency 20.0.3 Demonstrate basic knowledge of metal characteristics and formability			I	C		√
Competency Builders:						
20.0.3.1	Explain metal and formability basics		I	C		√
20.0.3.2	Explain metal grades		I	C		√
20.0.3.3	Explain tensile test		I	C		√
20.0.3.4	Explain R-value test			C		√
20.0.3.5	Explain hardness test		C	R		√
20.0.3.6	Explain interpretation of metal characteristics tests		I	C		√
20.0.3.7	Describe blank/die interactions (e.g., friction)		I	C		√
20.0.3.8	Describe friction and forming process		I	C		√
20.0.3.9	Describe circle grid basics			C		√
20.0.3.10	Describe the documentation process		I	C		√
20.0.3.11	Explain metal coatings		I	C		√
Competency 20.0.4 Demonstrate basic knowledge of casting			I	C		√
Competency Builders:						
20.0.4.1	Identify frequently used metals		I	C		√
20.0.4.2	Describe crystalline structure of metals		I	C		√
20.0.4.3	List chemical properties of common metals		I	C		√
20.0.4.4	List physical properties of common metals		I	C		√
20.0.4.5	Define permanent mold casting		I	C		√
20.0.4.6	Define shell mold casting		I	C		√
20.0.4.7	Define sand casting and pattern making		I	C		√
20.0.4.8	Define die casting		I	C		√
20.0.4.9	Identify basic casting terms		I	C		√
20.0.4.10	Identify advantages/disadvantages of casting processes		I	C		√

Unit 20: Basic Materials Science (cont)		10	12	AD	WS	LL
Competency 20.0.5 Demonstrate basic knowledge of iron and its alloys			I	C		√
Competency Builders:						
20.0.5.1	Define iron and its alloys		I	C		√
20.0.5.2	Describe iron manufacturing process		I	C		√
20.0.5.3	Describe the structure of iron and its alloys		I	C		√
20.0.5.4	List chemical properties of iron and its alloys		I	C		√
20.0.5.5	List physical properties of iron and its alloys		I	C		√
20.0.5.6	Describe iron and alloys property variables		I	C		√
20.0.5.7	Describe measures of strength for iron and its alloys		I	C		√
20.0.5.8	Identify examples of iron and its alloys processed by hot rolling, stamping, cold rolling, drawing, extrusion, spinning, casting, forging and machining		I	C		√
20.0.5.9	Perform tensile test		I	C		√
20.0.5.10	Perform hardness test		C	R		√
Competency 20.0.6 Demonstrate basic knowledge of aluminum and its alloys			I	C		√
Competency Builders:						
20.0.6.1	Define aluminum and its alloys		I	C		√
20.0.6.2	Describe aluminum manufacturing process		I	C		√
20.0.6.3	Describe the structure of aluminum		I	C		√
20.0.6.4	List chemical properties of aluminum		I	C		√
20.0.6.5	List physical properties of aluminum		I	C		√
20.0.6.6	Describe aluminum property variables		I	C		√
20.0.6.7	Identify examples of aluminum processed by cold rolling, drawing, extrusion, stamping, spinning, casting, forging and machining		I	C		√
20.0.6.8	Perform tensile test		I	C		√
20.0.6.9	Perform hardness test		C	R		√

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Unit 20: Basic Materials Science (cont)		10	12	AD	WS	LL
Competency 20.0.7	Demonstrate basic knowledge of copper and its alloys (e.g., brass, bronze)		I	C		√
20.0.7.1	Define copper and its alloys		I	C		√
20.0.7.2	Describe copper manufacturing process		I	C		√
20.0.7.3	Describe the structure of copper		I	C		√
20.0.7.4	List chemical properties of copper		I	C		√
20.0.7.5	List physical properties of copper		I	C		√
20.0.7.6	Describe copper property variables		I	C		√
20.0.7.7	Describe measures of copper strength		I	C		√
20.0.7.8	Identify examples of copper processed by cold rolling, drawing, extrusion, stamping, spinning, casting, forging and machining		I	C		√
20.0.7.9	Perform tensile test		I	C		√
20.0.7.10	Perform hardness test		C	R		√

Unit 20: Basic Materials Science (cont)		10	12	AD	WS	LL
Competency 20.0.8 Demonstrate basic knowledge of plastics and polymers (including rubber)			I	C		√
Competency Builders:						
20.0.8.1	Define plastics and polymers		I	C		√
20.0.8.2	Describe plastics, polymers, and composite preparation manufacturing processes		I	C		√
20.0.8.3	Describe structure of plastics and polymers		I	C		√
20.0.8.4	List common chemical properties of plastics and polymers		I	C		√
20.0.8.5	List common physical properties of plastics and polymers		I	C		√
20.0.8.6	Differentiate thermoset and thermoplastic		I	C		√
20.0.8.7	Describe plastics and polymer property variables		I	C		√
20.0.8.8	Describe measure of plastic and polymer strength		I	C		√
20.0.8.9	Identify examples of raw materials processed by machining, extrusion, stamping, injection molding, compression molding, injection compression molding, rotational, and blow molding		I	C		√
20.0.8.10	Identify molding defect (e.g., flash, sink marks, warp, contamination, wet material, stuck parts, short shot, burn marks, surface blemishes)		I	C		√
20.0.8.11	Identify secondary operations performed on plastic parts (e.g., plating, milling, painted)		I	C		√
20.0.8.12	Perform tensile, impact, flexural, and flame resistance tests			C		√

Unit 20: Basic Materials Science (cont)		10	12	AD	WS	LL
Competency: 20.0.9 Demonstrate basic knowledge of ceramics and composites				I		
Competency Builders:						
20.0.9.1	Explain ceramic tools and applications			I		
20.0.9.2	Describe the manufacturing of ceramic and composites components			I		
20.0.9.3	List tests used to evaluate ceramic and composites components			I		
20.0.9.4	Describe physical and chemical properties of ceramics and composites			I		
Competency 20.0.10 Demonstrate knowledge of corrosion and protection			I	C		√
Competency Builders:						
20.0.10.1	Identify causes of corrosion		I	C		√
20.0.10.2	List solutions to minimize problems		I	C		√

Unit 21: Welding Basics		10	12	AD	WS	LL
Competency: 21.0.1 Explain basic gas welding, brazing and cutting			I	R		
Competency Builders:						
21.0.1.1	Follow safety guidelines		I	R		
21.0.1.2	Differentiate welding and brazing		I	R		
21.0.1.3	Identify gas welding and cutting equipment and accessories		I	R		
21.0.1.4	Use personal protective equipment required for welding and cutting		I	R		
21.0.1.5	Explain capillary attraction as it applies to metal		I	R		
21.0.1.6	Demonstrate proper lighting, adjusting, and shutting down of gas torch		I	R		
21.0.1.7	Explain basic metallurgy technology		I	R		

Unit 21: Welding Basics (cont.)		10	12	AD	WS	LL
Competency: 21.0.2 Explain basic arc welding/cutting (i.e., stick)			I	R		
Competency Builders:						
21.0.2.1	Identify arc welding equipment and accessories		I	R		
21.0.2.2	Explain process of resistance welding		I	R		
21.0.2.3	Explain process of projection welding		I	R		
21.0.2.4	Explain process of flash-butt welding		I	R		
21.0.2.5	Explain process of laser welding		I	R		
21.0.2.6	Explain process of friction welding		I	R		
21.0.2.7	Explain process of spot welding		I	R		
21.0.2.8	Explain process of shielded metal-arc welding (SMAW)		I	R		
21.0.2.9	Explain process of gas metal-arc welding (GMAW)		I	R		
21.0.2.10	Explain process of gas tungsten-arc welding (GTAW)		I	R		
21.0.2.11	Explain process of plasma-arc cutting		I	R		
21.0.2.12	Explain process of carbon arc gouging and cutting		I	R		
21.0.2.13	Explain process of welding plastics		I	R		
21.0.2.14	Explain welding rod alloys		I	R		
21.0.2.15	Reading welding rods		I	R		
21.0.2.16	Explain mild steel welding rod		I	R		
21.0.2.17	Explain low hydrogen welding electrode		I	R		
21.0.2.18	Explain rationale for preheating and post-heating metal		I	R		
21.0.2.19	Explain (GMAW) welding in flat, horizontal, vertical positions		I	R		
21.0.2.20	Explain (GTAW) welding on mild steel, stainless steel, and aluminum		I	R		
21.0.2.21	Explain process of build up and hard facing		I	R		
21.0.2.22	Troubleshoot fusion of materials		I	R		

Unit 22: Press Technology	10	12	AD	WS	LL
Competency: 22.0.1 Explain press operation			C		
Competency Builders:					
22.0.1.1 Identify types of presses			C		
22.0.1.2 Describe functions of presses			C		
22.0.1.3 Identify capacity of presses			C		
22.0.1.4 Describe shutheight			C		
22.0.1.5 Identify operator safety devices			C		
Competency: 22.0.2 Demonstrate knowledge of press accessories			I		
Competency Builders:					
22.0.2.1 Describe function of monitors, proximity switches and die protection			I		
22.0.2.2 Describe function of loaders			I		
22.0.2.3 Describe function of roller levelers			I		
22.0.2.4 Describe function of decoilers			I		
22.0.2.5 Describe function of feeders			I		
22.0.2.6 Describe function of transfer mechanisms			I		
22.0.2.7 Describe function of lubricators and coolants			I		
22.0.2.8 Describe processing of coil steel			I		
22.0.2.9 Describe use of quick die change			I		
22.0.2.10 Describe press set-up			I		

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Unit 23: Sheet Metal Fabrication		10	12	AD	WS	LL
Competency: 23.0.1 Demonstrate knowledge of sheet metal fabrication			I	C		
Competency Builders:						
23.0.1.1	Describe sheet metal fabricated products		I	C		
23.0.1.2	Describe press working process		I	C		
23.0.1.3	Describe process(es) of straightening metal		I	C		
23.0.1.4	Describe metal finishing and coating		I	C		
23.0.1.5	Explain bend allowances		I	C		
23.0.1.6	Identify materials used for sheet metal fabrication (e.g., hot roll, cold roll, aluminum, stainless)		I	C		
23.0.1.7	Explain process of layout			C		
23.0.1.8	Explain process of fastening			C		
23.0.1.9	Explain process of punch and die clearance and alignment			C		
Competency: 23.0.2 Describe types of metal fabrication manufacturing			I	C		
Competency Builders:						
23.0.2.1	Describe shear		I	C		
23.0.2.2	Describe press brake		I	C		
23.0.2.3	Describe cut-to-length lines		I	C		
23.0.2.4	Describe roll forming		I	C		
23.0.2.5	Describe CNC turret presses		I	C		
23.0.2.6	Describe FMS cells		I	C		

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Unit 24: <i>Electrical Test and Measurement Equipment</i>	10	12	AD	WS	LL
Competency: 24.0.1 Demonstrate use of electrical test equipment		I	C		
Competency Builders:					
24.0.1.1 Apply test equipment to DC circuits		I	C		
24.0.1.2 Apply test equipment to AC circuits		I	C		
Competency: 24.0.2 Demonstrate use of electrical measurement equipment		I	I		
Competency Builders:					
24.0.2.1 Describe function and operation of analog volt-ohm-meter (AVOM)		I	C		
24.0.2.2 Describe function and operation of digital volt-ohm-meter (DVOM)		I	C		
24.0.2.3 Describe function and operation of oscilloscopes		I	R		
24.0.2.4 Apply measurement equipment to DC circuits		I	C		
24.0.2.5 Apply measurement equipment to Ac circuits		I	R		

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Unit 25: Geometric Dimensioning & Tolerancing		10	12	AD	WS	LL
Competency 25.0.1 Demonstrate knowledge of basic geometric dimensioning and tolerancing			I	C		
Competency Builders:						
25.0.1.1	Identify geometric characteristics and symbols (i.e., flatness, straightness, roundness, cylindricity, profile of line, profile of surface, perpendicularity, angularity, parallelism, circular, runout, total indicated runout, position, concentricity, and symmetry)		I	C		
25.0.1.2	Define maximum material condition		I	C		
25.0.1.3	Define least material condition		I	C		
25.0.1.4	Define regardless of feature size condition		I	C		
25.0.1.5	Describe feature control blocks		I	C		
25.0.1.6	Describe datum surfaces and targets		I	C		
25.0.1.7	Define flatness (pitch)		I	C		
25.0.1.8	Define straightness (yaw)		I	C		
25.0.1.9	Define roundness		I	C		
25.0.1.10	Define cylindrically		I	C		
25.0.1.11	Define profile of line		I	C		
25.0.1.12	Define profile of surface		I	C		
25.0.1.13	Define perpendicularity		I	C		
25.0.1.14	Define angularity		I	C		
25.0.1.15	Define parallelism		I	C		
25.0.1.16	Define circular runout		I	C		
25.0.1.17	Define total runout		I	C		
25.0.1.18	Define true position concept to determine tolerance for location of holes in mating parts		I	C		

Unit 25: Geometric Dimensioning & Tolerancing (cont)	10	12	AD	WS	LL
Competency: 25.0.2 Apply geometric dimensioning and tolerancing		I	C		
Competency Builders:					
25.0.2.1 Interpret decimal tolerance dimensions		I	C		
25.0.2.2 Calculate clearance fit tolerances of mating parts		I	C		
25.0.2.3 Dimension clearance fit tolerances of mating parts		I	C		
25.0.2.4 Calculate interference fit tolerances of mating parts		I	C		
25.0.2.5 Dimension interference fit tolerances of mating parts		I	C		
25.0.2.6 Calculate tolerances to mating parts using standard fit tables		I	C		
25.0.2.7 Assign tolerances to mating parts using standard fit tables		I	C		
25.0.2.8 Apply positional and form tolerancing symbols		I	C		
25.0.2.9 Apply symbols for true position		I	C		
25.0.2.10 Apply symbols for maximum material control and regardless of feature size		I	C		
25.0.2.11 Calculate effects of dimensional stack-up		I	C		
25.0.2.12 Calculate transitional fit tolerances		I	C		
25.0.2.13 Dimension transitional fit tolerances		I	C		

Unit 26: <i>Hydraulics and Pneumatics</i>	10	12	AD	WS	LL
Competency: 26.0.1 Describe fluid flow concepts		I	C		
Competency Builders:					
26.0.1.1 Explain Pascal's Law		I	C		
26.0.1.2 Explain Boyle's Law		I	C		
26.0.1.3 Explain Bernoulli's Principle		I	C		
26.0.1.4 Describe flow velocity		I	C		
26.0.1.5 Explain how heat and pressure relate to power and transmission		I	C		
26.0.1.6 Describe physical and chemical properties of a fluid		I	C		
26.0.1.7 Describe fluids in motion in closed conductors		I	C		
26.0.1.8 Describe continuity of mass flow		I	C		
26.0.1.9 Identify types of fluids		I	C		
26.0.1.10 Identify properties of fluids		I	C		
26.0.1.11 Identify English and metric units of measurement for pressure, density, and viscosity		I	C		
Competency: 26.0.2 Describe energy considerations		I	C		
Competency Builders:					
26.0.2.1 Differentiate work and power		I	C		
26.0.2.2 Differentiate potential and kinetic energy		I	C		
26.0.2.3 Explain energy conservation concept		I	C		
26.0.2.4 Explain hydraulic horsepower		I	C		
26.0.2.5 Explain work of compression in compressible fluids		I	C		

Unit 26: <i>Hydraulics and Pneumatics (cont)</i>	10	12	AD	WS	LL
Competency: 26.0.3 Describe system losses		I	C		
Competency Builders:					
26.0.3.1 Differentiate turbulent and laminar flow		I	C		
26.0.3.2 Explain friction factor		I	C		
26.0.3.3 Explain pressure losses		I	C		
26.0.3.4 Identify potential system losses (e.g., leaks, wear, component sizing, heat, dirt)		I	C		
Competency: 26.0.4 Describe hydrostatics		I	C		
Competency Builders:					
26.0.4.1 Explain pressure, density, and viscosity		I	C		
26.0.4.2 Explain buoyancy		I	C		
26.0.4.3 Explain equilibrium		I	C		
Competency: 26.0.5 Calculate energy		I	C		
Competency Builders:					
26.0.5.1 Apply Pascal's Law		I	C		
26.0.5.2 Apply Bernoulli's Principle		I	C		
26.0.5.3 Apply Boyle's Law		I	C		
26.0.5.4 Calculate work and power		I	C		
26.0.5.5 Calculate potential and kinetic energy		I	C		
26.0.5.6 Calculate hydraulic horsepower		I	C		
26.0.5.7 Calculate flow velocity and pressure		I	C		
26.0.5.8 Calculate pressure losses		I	C		
26.0.5.9 Calculate laminar flow			C		
26.0.5.10 Calculate pump capacity		I	C		
26.0.5.11 Calculate system requirements		I	C		

Unit 26: <i>Hydraulics and Pneumatics (cont)</i>	10	12	AD	WS	LL
Competency: 26.0.6 Design basic hydraulic/pneumatic system			C		
Competency Builders:					
26.0.6.1 Use common symbols			C		
26.0.6.2 Create circuit diagrams (i.e., schematics)			C		
26.0.6.3 Diagram closed-loop hydraulic system			C		
26.0.6.4 Diagram an air supply system			C		
Competency: 26.0.7 Describe component operation			C		
Competency Builders:					
26.0.7.1 Identify functions and operation of hydraulic components			C		
26.0.7.2 Identify functions and operation of pneumatic components			C		
26.0.7.3 Explain application(s) of different materials (e.g., plastic, copper)			C		
Competency: 26.0.8 Interpret hydraulic and pneumatic schematics			C		
Competency Builders:					
26.0.8.1 Identify common symbols			C		
26.0.8.2 Sketch circuit diagrams (i.e., schematics)			C		
26.0.8.3 Interpret circuit diagrams (i.e., schematics)			C		
26.0.8.4 Sketch circuit analysis			C		
26.0.8.5 Diagram an air supply system			C		
Competency: 26.0.9 Troubleshoot hydraulic circuits			I		
Competency Builders:					
26.0.9.1 Analyze hydraulic circuits			C		
26.0.9.2 Troubleshoot hydraulic circuits			I		

Unit 26: <i>Hydraulics and Pneumatics (cont)</i>	10	12	AD	WS	LL
Competency: 26.0.10 Explain pump operation			C		
Competency Builders:					
26.0.10.1 Identify types and operating features of pumps			C		
26.0.10.2 Identify pump capacity and system requirements			C		
26.0.10.3 Explain packing and seal requirements			C		
26.0.10.4 Explain operating principles of pumps (e.g., centrifugal, propeller and turbine rotary, metering)			C		
Competency: 26.0.11 Explain piping and accessories for low pressure fluid power systems			C		
Competency Builders:					
26.0.11.1 Identify components of a piping system			C		
26.0.11.2 Explain features of both metallic and non-metallic piping systems			C		
26.0.11.3 Explain types of valves and their operation and maintenance			C		
26.0.11.4 Explain use of strainers, filters, and traps in piping systems			C		
Competency: 26.0.12 Describe reciprocating and rotary air compressors			I		
Competency Builders:					
26.0.12.1 Explain relationship of force, weight, mass, and density in pneumatic system			I		
26.0.12.2 Explain operation of reciprocating compressors			I		
26.0.12.3 Explain operation of rotary compressors			I		
26.0.12.4 Explain primary and secondary air treatment (e.g., air dryers, lubricating systems)			I		
26.0.12.5 Explain operation of compressor valves, cylinders, and motors			I		

Unit 27: Basic Electronics		10	12	AD	WS	LL
Competency: 27.0.1 Demonstrate proficiency in electronics fundamentals			I	C		
Competency Builders:						
27.0.1.1	Identify electronic components and schematic symbols		I	C		
27.0.1.2	Describe basic atomic structure and its relationship to electricity	I	R	C		
27.0.1.3	Describe the relationship between electrical and magnetic properties		I	C		
27.0.1.4	Describe the electrical and magnetic properties of a magnet		I	C		
27.0.1.5	Describe the photoelectric effect		I	C		
27.0.1.6	Describe the thermocouple effect		I	C		
27.0.1.7	Describe the electrical effect of friction		I	C		
27.0.1.8	Use S.I. units to solve electronic unit problems		I	C		
27.0.1.9	Identify sources of electricity		I	C		
27.0.1.10	Describe principles and operations of electrochemical supplies		I	C		
27.0.1.11	Describe voltage, current, resistance, power and energy		I	C		
27.0.1.12	Apply Ohm's Law		I	C		
27.0.1.13	Apply Kirchoff's Laws			C		
27.0.1.14	Apply power formulas		I	C		
27.0.1.15	Interpret color codes and symbols to identify electrical components and values			C		
27.0.1.16	Measure properties of circuits using test equipment		I	C		

Unit 27: Basic Electronics (cont)		10	12	AD	WS	LL
Competency: 27.0.2 Demonstrate proficiency in DC circuits			I	R		
Competency Builders:						
27.0.2.1	Compute conductance of conductors and insulators		I	C		
27.0.2.2	Measure resistance and current of conductors and insulators		I	C		
27.0.2.3	Measure properties of a circuit using volt-ohm meter (VOM) and digital volt-ohm meter (DVM)		I	C		
27.0.2.4	Build series, parallel, and combination circuits		I	C		
27.0.2.5	Build bridge circuits			C		
27.0.2.6	Build voltage divider circuits (loaded and unloaded)			C		
27.0.2.7	Compute voltage divider circuits (loaded and unloaded)			C		
27.0.2.8	Describe magnetic properties of circuits and devices			C		
27.0.2.9	Explain physical and electrical characteristics of capacitors and inductors		I	C		
27.0.2.10	Describe RC and RL time constants			C		
27.0.2.11	Compute RC and RL time constants			C		
27.0.2.12	Operate power supplies for DC circuits		I	C		
27.0.2.13	Describe frequency spectrums		I	C		
27.0.2.14	Use meters and oscilloscopes		I	C		
27.0.2.15	Measure current, voltage, and resistance in DC circuits		I	C		
27.0.2.16	Explain simple DC generator action		I	R		
27.0.2.17	Explain simple DC motor action		I	R		
27.0.2.18	Solve algebraic problems to include exponential (prerequisite to DC) algebraic calculation		I	C		
27.0.2.19	Identify use of circuit protective devices (e.g., fuses, breakers)		I	C		
27.0.2.20	Troubleshoot DC circuits			C		

Unit 27: Basic Electronics (cont)		10	12	AD	WS	LL
Competency: 27.0.3 Demonstrate proficiency in AC circuits			I	C		
Competency Builders:						
27.0.3.1	Analyze properties of an AC signal		I	C		
27.0.3.2	Describe principles and operation of characteristics of sinusoidal and non-sinusoidal wave forms		I	C		
27.0.3.3	Identify AC sources		I	C		
27.0.3.4	Describe principles and operation of characteristics of capacitive circuits			C		
27.0.3.5	Operate capacitive circuits			C		
27.0.3.6	Describe principles and operation of characteristics of inductive circuits			C		
27.0.3.7	Operate inductive circuits			C		
27.0.3.8	Describe principles and operation of transformers			C		
27.0.3.9	Demonstrate operation of AC circuits utilizing transformers			C		
27.0.3.10	Measure power in AC circuits		I	C		
27.0.3.11	Identify use of circuit protective devices (e.g., fuses, breakers)			C		
27.0.3.12	Describe basic motor theory and operation		I	C		
27.0.3.13	Describe basic generator theory and operation		I	C		
27.0.3.14	Operate power supplies for AC circuits		I	C		
27.0.3.15	Describe principles and operation of various safety grounding systems (e.g., lightning arresters, ground electrostatic discharge, fault interrupters, etc.)			C		
27.0.3.16	Describe characteristics of inductors in series and parallel circuits			C		
27.0.3.17	Describe characteristics of capacitance in series and parallel circuits			C		
27.0.3.18	Compare resistive-capacitive (RC) and resistive-inductive (RL) time constants (TC)			C		
27.0.3.19	Measure voltage, current, time, frequency (f), and phase relationships of AC sine wave signal		I	C		
27.0.3.20	Describe frequency (F) and phase relationships		I	C		

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Unit 27: Basic Electronics (cont)	10	12	AD	WS	LL
Competency: 27.0.3 Demonstrate proficiency in AC circuits (cont.)					
Competency Builders:					
27.0.3.21 Measure current, voltage, and resistance in AC circuits		I	C		
27.0.3.22 Identify 50/60 Hertz		I	C		
27.0.3.23 Explain simple AC generator action		I	C		
27.0.3.24 Explain simple AC motor action		I	C		
27.0.3.25 Calculate power factor in AC circuits		I	C		
27.0.3.26 Calculate peak (PK), root mean square (RMS), and average values			C		
27.0.3.27 Troubleshoot AC circuits			C		

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Unit 28: Electromechanical Technology	10	12	AD	WS	LL
Competency: 28.0.1 Describe the operation of electronic sensors and transducers			I		
Competency Builders:					
28.0.1.1 Explain temperature transducers operation			I		
28.0.1.2 Explain liquid and fluid flow transducers operation			I		
Competency: 28.0.2 Demonstrate knowledge of transducers (sensors) and instrumentation			I		
Competency Builders:					
28.0.2.1 Describe thermocouple characteristics		I			
28.0.2.2 Describe characteristics associated with transducers and instrumentation			I		
28.0.2.3 Describe the principles and operations of various types of transducers (e.g., thermal, shock/vibration, acceleration, positional, pressure, flow, optical, gas, and humidity)			I		
28.0.2.4 Demonstrate the use of various transducers (e.g., thermal, shock/vibration, acceleration, positional, pressure, flow, optical, gas, and humidity)			I		
28.0.2.5 Differentiate among thermocouple types			I		
28.0.2.6 Interpret specifications of temperature sensors (e.g., thermocouples, thermistors, resistance temperature devices)			I		
28.0.2.7 Interpret specifications of flow sensors (e.g., orifice flow meter, turbine meter, mass flow meters)			I		
28.0.2.8 Explain use of photo electric sensors		I	R		
28.0.2.9 Demonstrate the use of control and measurement circuits			I		
Competency: 28.0.3 Demonstrate knowledge of motors and motor controls			I		
Competency Builders:					
28.0.3.1 Describe operation of common AC motors			I		
28.0.3.2 Define advantages and disadvantages of common DC motors			I		

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Unit 29: Programmable Logic Controllers (PLCs)	10	12	AD	WS	LL
Competency: 29.0.1 Demonstrate use of PLCs		I	R		
Competency Builders:					
29.0.1.1 Draw block diagram of a PLC		I	R		
29.0.1.2 Define individual blocks of a PLC		I	R		
29.0.1.3 Use operator's and/or manufacturer's manual(s)		I	R		
29.0.1.4 Translate relay logic to logic for a PLC		I	R		
29.0.1.5 Operate timers, counters and sequencers		I	R		
29.0.1.6 Operate analog I/O modules		I	R		
29.0.1.7 Write a statement and ladder logic program		I	R		
29.0.1.8 Document a statement and ladder logic program		I	R		
Competency: 29.0.2 Explain basic operation of PLCs		I	R		
Competency Builders:					
29.0.2.1 Describe basic applications of PLCs		I	R		
29.0.2.2 Identify program symbols and language functions		I	R		
29.0.2.3 Describe function of block transfers		I	R		
29.0.2.4 Describe operation of timers, counters, and sequences		I	R		
29.0.2.5 Describe operation of analog I/O modules		I	R		
29.0.2.6 Describe operation of servo motion control		I	R		
29.0.2.7 Describe the principles and operation of PLCs		I	R		

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Unit 30: Mechanical Power Transmission		10	12	AD	WS	LL
Competency 30.0.1: Demonstrate knowledge of basic mechanics			I	C		
Competency Builders:						
30.0.1.1	Explain working forces of torque, tension, and compression		I	C		
30.0.1.2	Explain the laws of motion		I	C		
30.0.1.3	Explain how to calculate work in several ways		I	C		
30.0.1.4	Explain the function of simple machines including levers, inclined plane, wedge, wheel and axle, pulley and screw, gears		I	C		
30.0.1.5	Explain the types of power and the method of producing power		I	C		
30.0.1.6	Explain the laws of friction		I	C		
30.0.1.7	Explain mechanical efficiency		I	C		
30.0.1.8	Apply basic knowledge of physics		I	C		
30.0.1.9	Apply basic knowledge of stress, strain and fatigue			C		
30.0.1.10	Calculate speed changes		I	C		

Unit 30: Mechanical Power Transmission (cont)		10	12	AD	WS	LL
Competency 30.0.2: Describe mechanical power transmission systems				C		
Competency Builders:						
30.0.2.1	Describe the principles and operations of compound and reverted gear trains			C		
30.0.2.2	Describe the principles and operations of internal and planetary gear trains			C		
30.0.2.3	Describe the principles and operations of helical and bevel gear trains			C		
30.0.2.4	Describe the principles and operations of rack and pinion, worm and wheel, and block and screw mechanisms			C		
30.0.2.5	Describe the principles and operations of counter rotating mechanisms and differentials			C		
30.0.2.6	Describe the principles and operations of spring mechanisms, pulley blocks and differentials			C		
30.0.2.7	Describe the principles and operations of chain, belt and disc drives and universal joints			C		
30.0.2.8	Describe the principles and operations of clutch and coupling mechanisms			C		
30.0.2.9	Describe the principles and operations of braking mechanisms			C		
30.0.2.10	Describe the necessity for proper alignment and fit of mechanical devices			C		
30.0.2.11	Describe the necessity for proper balance of system components			C		
30.0.2.12	Describe proper component matching (e.g., sheave sets, gear sets)			C		

Unit 30: Mechanical Power Transmission (cont)	10	12	AD	WS	LL
Competency 30.0.3: Demonstrate knowledge of bearing applications			C		
Competency Builders:					
30.0.3.1 Define bearing			C		
30.0.3.2 Identify types of bearings and their applications			C		
30.0.3.3 Identify installation method			C		
30.0.3.4 Explain bearing installation			C		
30.0.3.5 Explain bearing maintenance (e.g., lubrication)			C		
30.0.3.6 Explain bearing removal			C		
30.0.3.7 Identify bearing failure modes			C		
30.0.3.8 Select bearings			C		
30.0.3.9 Design mounting for bearings			C		
Competency 30.0.4: Demonstrate knowledge of seal applications			C		
Competency Builders:					
30.0.4.1 Define seal			C		
30.0.4.2 Identify types of seals and their applications			C		
30.0.4.3 Identify installation method			C		
30.0.4.4 Explain seal installation			C		
30.0.4.5 Explain seal maintenance			C		
30.0.4.6 Explain seal removal			C		
30.0.4.7 Identify seal failure modes			C		

Unit 30: Mechanical Power Transmission (cont)	10	12	AD	WS	LL
Competency 30.0.5: Demonstrate knowledge of gear applications			C		
Competency Builders:					
30.0.5.1 Define gears		I	C		
30.0.5.2 Identify types of gears, their materials, and their applications			C		
30.0.5.3 Identify installation method			C		
30.0.5.4 Explain gear installation			C		
30.0.5.5 Explain gear maintenance (e.g., lubrication)			C		
30.0.5.6 Explain gear removal			C		
30.0.5.7 Identify gear failure modes			C		
30.0.5.8 Identify gear requirements			C		
30.0.5.9 Select gears appropriate to the application			C		
30.0.5.10 Calculate gear requirements			C		
Competency 30.0.6: Demonstrate knowledge of belt and pulley applications			I		
Competency Builders:					
30.0.6.1 Define belts and pulleys		I	R		
30.0.6.2 Identify types of belts and pulleys and their applications			I		
30.0.6.3 Identify installation method			I		
30.0.6.4 Explain belt and pulley installation			I		
30.0.6.5 Explain belt and pulley maintenance			I		
30.0.6.6 Explain belt and pulley removal			I		
30.0.6.7 Identify belt and pulley failure modes			I		
30.0.6.8 Identify belt and pulley requirements			I		
30.0.6.9 Select belt and pulley appropriate to the application			I		
30.0.6.10 Calculate belt and pulley requirements			I		

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Unit 30: Mechanical Power Transmission (cont)	10	12	AD	WS	LL
Competency 30.0.7: Demonstrate knowledge of sprocket and chain applications			I		
Competency Builders:					
30.0.7.1 Define sprockets and chains			I		
30.0.7.2 Identify types of sprockets and chains and their applications			I		
30.0.7.3 Identify installation method			I		
30.0.7.4 Explain sprocket and chain installation			I		
30.0.7.5 Explain sprocket and chain maintenance			I		
30.0.7.6 Explain sprocket and chain removal			I		
30.0.7.7 Identify sprocket and chain failure modes			I		
30.0.7.8 Identify sprocket and chain requirements			I		
30.0.7.9 Select sprocket and chain appropriate to the application			I		
30.0.7.10 Calculate sprocket and chain requirements			I		
Competency 30.0.8: Demonstrate knowledge of clutches and brakes applications			I		
Competency Builders:					
30.0.8.1 Define clutches and brakes			I		
30.0.8.2 Identify types of clutches and brakes and their applications			I		
30.0.8.3 Identify installation method			I		
30.0.8.4 Explain clutch and brake installation			I		
30.0.8.5 Explain clutch and brake maintenance			I		
30.0.8.6 Explain clutch and brake removal			I		
30.0.8.7 Identify clutch and brake failure modes			I		
30.0.8.8 Identify clutch and brake requirements			I		
30.0.8.9 Select clutches and brakes appropriate to the application			I		
30.0.8.10 Calculate clutch and brake requirements			I		

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Unit 30: Mechanical Power Transmission (cont)	10	12	AD	WS	LL
Competency 30.0.9: Demonstrate knowledge of drive component applications			I		
Competency Builders:					
30.0.9.1 Define drive component			I		
30.0.9.2 Identify types of drive components and their applications			I		
30.0.9.3 Identify installation method			I		
30.0.9.4 Explain drive component installation			I		
30.0.9.5 Explain drive component maintenance			I		
30.0.9.6 Explain drive component removal			I		
30.0.9.7 Identify drive component failure modes			I		
30.0.9.8 Identify drive component requirements			I		
30.0.9.9 Select drive component appropriate to the application			I		
30.0.9.10 Calculate drive component requirements			I		

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Unit 31: Production Methods and Costs	10	12	AD	WS	LL
Competency 31.0.1: Apply design processes to determine a recommended solution to a methods problem			C		
Competency Builders:					
31.0.1.1 Form the problem (Phase One)			C		
31.0.1.2 Analyze the problem (Phase Two)			C		
31.0.1.3 Determine alternative solutions (Phase Three)			C		
31.0.1.4 Evaluate the alternative solutions (Phase Four)			C		
31.0.1.4 Determine specifications for the chosen solution (Phase Five)			C		
31.0.1.5 Explain how to sell and install the chosen solution (Phase Five)			C		
Competency 31.0.2: Apply diagrammatic aids used in methods work			C		
Competency Builders:					
31.0.2.1 Apply a flow diagram			C		
31.0.2.2 Apply a flow chart			C		
31.0.2.3 Apply a precedent diagram and multiple activities chart			C		
31.0.2.4 Apply a Gantt chart			C		
31.0.2.5 Apply an operation processes chart			C		
31.0.2.6 Apply a trip frequency chart			C		
31.0.2.7 Apply a learning curve			C		

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Unit 32: Production Methods and Costs (cont)	10	12	AD	WS	LL
Competency 31.0.3: Apply the principles of motion economy to the solution of industrial problems			I		
Competency Builders:					
31.0.3.1 Determine I.E. standards and M.O.S.T.			I		
31.0.3.2 Formalize methods for economic technology problem solving			C		
Competency 31.0.4: Determine operating costs of each alternative			C		
Competency Builders:					
31.0.4.1 Apply standard costs to manufacturing alternatives			C		
31.0.4.2 Design for Manufacturing (DFM)			C		

Unit 32: Engineering Mechanics	10	12	AD	WS	LL
Competency 32.0.1: Determine all support reactions and forces acting on all internal two-force members of a statically loaded coplanar system in equilibrium, using the equation of friction as required			C		
Competency Builders:					
32.0.1.1 Find the resultant of a parallel force system in equilibrium		I	C		
32.0.1.2 Find the resultant of concurrent force systems in equilibrium			C		
32.0.1.3 Use the concept of distributed force in solution of problems			C		
32.0.1.4 Determine stresses in trusses			C		
32.0.1.5 Find the resultant of noncurrent force systems in equilibrium			C		
Competency 32.0.2: Determine all support reactions and forces acting on all internal two-force members of a statically loaded noncoplanar system in equilibrium, using the equation of friction as required			C		
Competency Builders:					
32.0.2.1 Draw free body diagrams			C		
32.0.2.2 Use equations of equilibrium			C		
32.0.2.3 Use graphical solutions			C		
Competency 32.0.3 Solve force system problems utilizing equations of frictions		I	C		
Competency Builders:					
32.0.3.1 Use coefficient of friction		I	C		
32.0.3.2 Use angle of friction			C		
32.0.3.3 Use laws of friction		I	C		
32.0.3.4 Solve problems involving belt friction			C		

Unit 32: Engineering Mechanics (cont)	10	12	AD	WS	LL
Competency 32.0.4: Determine analytically the forces acting on all internal members by the application of the method of joints and the method of sections, given a statically loaded truss			C		
Competency Builders:					
32.0.4.1 Determine the forces on all internal members using the method of joints			C		
32.0.4.2 Determine the forces on all internal members using the method of sections			C		
Competency 32.0.5: Determine the location of the center of gravity, given all dimensions of any simple and composite geometrical areas			C		
Competency Builders:					
32.0.5.1 Calculate centroids and centers of gravity			C		
32.0.5.2 Calculate centroids of simple geometric areas			C		
32.0.5.3 Calculate centroids of composite areas			C		
Competency 32.0.6: Determine the moment of inertia of any composite geometrical area			C		
Competency Builders:					
32.0.6.1 Calculate moments of inertia of simple areas		I	C		
32.0.6.2 Calculate moments of inertia of composite areas			C		
32.0.6.3 Determine radius of gyration			C		

Unit 33: Advanced Engineering Mechanics	10	12	AD	WS	LL
Competency 33.0.1: Apply equations of kinematics and kinetics to solve for unknown forces and motions, given a rectilinear system having unbalanced forces, applying the equations of friction as required			C		
Competency Builders:					
33.0.1.1 Solve equations of rectilinear motion			C		
33.0.1.2 Apply inertia force, dynamic equilibrium, friction and other forces in the solution of problems of systems of motion			C		
33.0.1.3 Apply valid checking to all problem solutions to verify answers			C		
Competency 33.0.2: Apply equations of kinematics and kinetics to solve for unknown forces and motions, given a curvilinear system having unbalanced forces, applying the equations of friction as required			C		
Competency Builders:					
33.0.2.1 Solve problems using normal acceleration		I	C		
33.0.2.2 Solve problems using tangential acceleration			C		
33.0.2.3 Solve problems involving projectile motion			C		
33.0.2.4 Solve problems involving curvilinear motion in vertical plane			C		
33.0.2.5 Apply valid checking to all problem solutions to verify answers			C		

Unit 33: Advanced Engrg. Mechanics (cont.)	10	12	AD	WS	LL
Competency 33.0.3: Apply equations of kinematics and kinetics of rotation		I	C		
Competency Builders:					
33.0.3.1 Solve problems of angular displacement, velocity and acceleration		I	C		
33.0.3.2 Solve problems of inertial moment		I	C		
33.0.3.3 Solve problems of dynamic equilibrium of rotating bodies			C		
33.0.3.4 Solve problems of center of percussion			C		
Competency 33.0.4: Determine unknown forces and motions in a body experiencing plane motion			C		
Competency Builders:					
33.0.4.1 Find instantaneous center			C		
33.0.4.2 Solve problems involving the kinematics of plane motion			C		
33.0.4.3 Solve problems involving the kinetics of plane motion			C		
33.0.4.4 Apply valid checking to all problem solutions to verify answers			C		
Competency 33.0.5: Apply the concepts of work, energy, and power in the solution of problems and engineering mechanics		I	C		
Competency Builders:					
33.0.5.1 Solve problems using the concept of potential and kinetic energy		I	C		
33.0.5.2 Solve problems using the concept of conservation of energy		I	C		
33.0.5.3 Determine the amount of power required and the efficiency of a rotating body		I	C		
33.0.5.4 Apply valid checking to all problem solutions to verify answers			C		

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Unit 34: Computer Programming	10	12	AD	WS	LL
Competency 34.0.1: Demonstrate fundamental programming skills in a language such as FORTRAN, PASCAL, VISUAL BASIC, or C			I		
Competency Builders:					
34.0.1.1 Create a program file in an IDE or appropriate editor			C		
34.0.1.2 Compile, link, and run a program			C		
34.0.1.3 Use a debugger or IDE diagnostics to troubleshoot programs			C		
34.0.1.4 Use program statements to read data from the keyboard and report program output on the user or graphics screens			C		
34.0.1.5 Use both free and formatted IO			C		
34.0.1.6 Use conditional operations to perform branching			C		
34.0.1.7 Use definite and indefinite looping operations to perform repetitive tasks			C		
34.0.1.8 Use mathematical operations to solve simple engineering problems			C		
34.0.1.9 Use subscripted variables to store and process individual data values			C		
34.0.1.10 Use both procedure and function type subprograms			C		
34.0.1.11 Pass parameters to and from subprograms			C		
34.0.1.12 Write clear but terse program documentation			C		
34.0.1.13 Add requested new features to programs provided			C		
34.0.1.14 Participate in a group effort in which each team member helps to design and implement a large program			I	√	
34.0.1.15 Use computer graphics and audio capabilities if available			I	√	
34.0.1.16 Make extensive use of on-line help capabilities to search for and learn to use new program features			C		
34.0.1.17 Anticipate and trap mistakes by the program user			C		
34.0.1.18 Write programs to solve engineering problems involving extensive calculations or data processing or machine control			C		

Unit 35: Computer-Based Descriptive Geometry		10	12	AD	WS	LL
Competency 35.0.1: Demonstrate knowledge of computer-based descriptive geometry as a graphical tool to solve design problems				C		
Competency Builders:						
35.0.1.1	Determine or specify direction by either Bearing or Azimuth			C		
35.0.1.2	Find the True Length of a line in any spacial orientation by either the rotation or auxiliary view methods			C		
35.0.1.3	Determine the True Angle that a line makes with a principle view, auxiliary view, or any spacial orientation of a plan			C		
35.0.1.4	Find the point or end view of any line in space			C		
35.0.1.5	Find the shortest distance or shortest line of a given grade between a point and line or between two skew lines			C		
35.0.1.6	Find the edge view of a plane in any orientation in space, using either the rotation or auxiliary view methods			C		
35.0.1.7	Determine the true angle that a plan makes with the horizontal plane or the true angle between any two planes in space			C		
35.0.1.8	Find the true view of any plane in space regardless of its orientation, using either the rotation or the auxiliary view mthods			C		
35.0.1.9	Find the spacial relationship between points, lines, and plans, including the shortest distance point to plane and true angle between line and plane			C		
35.0.1.10	Find the points or line of intersection between line, plane, or curved surfaces and polyhedrons, cylinders, and cones			C		
35.0.1.11	Determine the strike, dip, outcrop, and thickness or an ore vein from these borings			C		
35.0.1.12	Find the line of intersection between a plane surface derived from a cut or fill and contours of a topographical map			C		

Unit 36: Product Design		10	12	AD	WS	LL
Competency 36.0.1: Demonstrate knowledge of the design process			I	C		
Competency Builders:						
36.0.1.1	Explain how to determine needs		I	C		
36.0.1.2	Explain how to conduct a preliminary study using various techniques (e.g., brainstorming, research, surveys, idea scanning, set parameters and constraints)		I	C		
36.0.1.3	Explain items to be considered during development of design (e.g., physical, social, materials, safety, reliability, appearance, maintenance, resources)		I	C		
36.0.1.4	Explain evaluation of design (e.g., prototype, testing, revisions, refinement)		I	C		
36.0.1.5	Demonstrate knowledge of implementation procedures (e.g., installation, training)		I	C		
Competency 36.0.2: Design a product			I	C		
Competency Builders:						
36.0.2.1	Apply the design process to achieve the optimum design of a product		I	C		
36.0.2.2	Integrate the aesthetic appearance of a product with the functional design		I	C		
36.0.2.3	Explore alternative design options in the refinement of the product		I	C		
36.0.2.4	Select and develop drive, mechanism, or system appropriate to achieve the desired function			C		
36.0.2.5	Specify provision and surface treatment suitable for intended use		I	C		
36.0.2.6	Submit a complete set of production drawings		I	C		
36.0.2.7	Choose a method of production appropriate to meet design criteria		I	C		

Unit 37: Design of Machines and Machine Elements	10	12	AD	WS	LL
Competency 37.0.1: Demonstrate a knowledge of the design approach			C		
Competency Builders:					
37.0.1.1 Identify the core problem(s) of a design situation			C		
37.0.1.2 Use reference sources, engineering handbooks, and design manuals			C		
37.0.1.3 Write computer problems to solve design problems			C		
Competency 37.0.2: Determine stress and deformation on machine elements under axial, torsional and transverse load			C		
Competency Builders:					
37.0.2.1 Solve problems involving axial tension, compression, shear, and bearing stresses and strains			C		
37.0.2.2 Solve problems involving torsional stresses and strains			C		
37.0.2.3 Analyze rotating shafts and their couplings			C		
37.0.2.4 Draw shear and moment diagrams for cantilever, overhanging, and simply-supported beams subjected to concentrated, distributed loads and couples			C		
37.0.2.5 Analyze and design beams and fabricated structures having simple geometric shapes			C		
37.0.2.6 Draw Mohr's circle to establish the principal stresses and maximum shearing stresses			C		
37.0.2.7 Analyze and design structural elements subjected to combined normal and shearing stresses			C		
37.0.2.8 Determine the deflection of cantilever, overhanging, and simply-supported beams using the moment-area method			C		

Unit 37: Design of Machines and Machine Elements (cont)		10	12	AD	WS	LL
Competency 37.0.3: Use the machine design process in the design and/or selection or primary machine elements				C		
Competency Builders:						
37.0.3.1	Size and select keys, pins, splines and threaded fasteners			C		
37.0.3.2	Design power screws			C		
37.0.3.3	Design shaft and shaft mountings			C		
37.0.3.4	Design gear systems			C		
37.0.3.5	Select and specify bearings and lubrication system and components			C		
37.0.3.6	Select couplings, clutches and brakes			C		
37.0.3.7	Select chain drives, belt drives and flywheels			C		
37.0.3.8	Select springs			C		
37.0.3.9	Use factor of safety and metal fits and tolerances in the solution of machine design problems			C		

Unit 38: Quality	10	12	AD	WS	LL
Competency 38.0.1: Demonstrate knowledge of basic mathematical methods required for quality applications		I	C		
Competency Builders:					
38.0.1.1 Manipulate basic mathematical operations (addition, subtraction, multiplication, division)		C			
38.0.1.2 Manipulate mathematical operations using fractions		C			
38.0.1.3 Manipulate mathematical operations using decimals		C			
38.0.1.4 Manipulate mathematical operations using scientific notation		I	C		
38.0.1.5 Manipulate mathematical operations using percentages		C			
38.0.1.6 Manipulate mathematical operations using metric and English measurement systems		I	C		
38.0.1.7 Manipulate mathematical operations using metric prefixes		I	C		
38.0.1.8 Perform error calculation		I	C		
38.0.1.9 Calculate areas and volumes		C			
38.0.1.10 Solve algebraic equations in one variable		C	R		
38.0.1.11 Graph linear equations		C	R		
38.0.1.12 Construct bar graphs and histograms		I	C		
38.0.1.13 Perform angle measurement		C	R		
38.0.1.14 Interpret summation notation		I	C		

Unit 38: Quality (cont)	10	12	AD	WS	LL
Competency 38.0.2: Demonstrate a knowledge of basic statistical methods for quality control		I	C		
Competency Builders:					
38.0.2.1 Use graphical data presentation techniques		I	C		
38.0.2.2 Use frequency distributions and cumulative frequency distributions		I	C		
38.0.2.3 Calculate summary statistics (mean and standard deviation)		I	C		
38.0.2.4 Apply Tschebychev's Theorem			C		
38.0.2.5 Define probabilities for simple engineering problems		I	C		
38.0.2.6 Calculate probabilities for simple engineering problems		I	C		
38.0.2.7 Apply probability rules (AND, OR, NOT) to problems			C		
38.0.2.8 Perform expectation calculations for business and quality control problems			C		
38.0.2.9 Calculate fundamental probability distributions to quality control problems in SPC and Acceptance Sampling			C		
38.0.2.10 Apply fundamental probability distributions to quality control problems in SPC and Acceptance Sampling			C		
38.0.2.11 Use approximation methods for calculation of probabilities and interpretation of quality control problems			C		
38.0.2.12 Explain the conditions required for use of the Central Limit Theorem			C		
38.0.2.13 Identify the conditions required for use of the Central Limit Theorem			C		
38.0.2.14 Construct large sample confidence intervals for population means			C		
38.0.2.15 Perform hypothesis tests in the context of SPC and Acceptance Sampling Problems			C		
38.0.2.16 Interpret Type 1 and Type 2 errors and their impact on decision making			C		
38.0.2.17 Use operating characteristic curves to compare sampling plans			C		

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Unit 38: Quality (cont)	10	12	AD	WS	LL
Competency 38.0.3: Demonstrate a knowledge of statistical process control			C		
Competency Builders:					
38.0.3.1 Select rational subgroups for sampling applications			C		
38.0.3.2 Evaluate run rules to interpret SPC charts			C		
38.0.3.3 Use the Western Electric rules to determine the state of a process			C		
38.0.3.4 Describe both appropriate and inappropriate control activities, including managerial tampering			C		
38.0.3.5 Recognize the risks of computerized SPC implementations			C		
38.0.3.6 Design control charts for attribute data (defects and defectives)			C		
38.0.3.7 Construct control charts for attribute data (defects and defectives)			C		
38.0.3.8 Interpret control charts for attribute data (defects and defectives)			C		
38.0.3.9 Apply attribute charts in administrative, general business, safety, material handling, and other nontraditional SPC applications			C		
38.0.3.10 Design control charts for variables data			C		
38.0.3.11 Construct control charts for variables data			C		
38.0.3.12 Interpret control charts for variables data			C		
38.0.3.13 Demonstrate understanding of the management of sample size, sampling intervals, and parameter selection in a large SPC application			C		
38.0.3.14 Calculate meaningful process capability statistics			C		
38.0.3.15 Interpret meaningful process capability statistics			C		
38.0.3.16 Demonstrate knowledge of non-Shewhart type SPC charts			C		

<i>Unit 38: Quality (cont)</i>	10	12	AD	WS	LL
Competency 38.0.4: Demonstrate knowledge of Acceptance Sampling Methods			C		
Competency Builders:					
38.0.4.1 Operate single and double sampling plans		I	C		
38.0.4.2 Design single and double sampling plans to meet selected risk levels			C		
38.0.4.3 Use OC curves to evaluate and compare the performance of different sampling plans			C		
38.0.4.4 Use ASN curves to evaluate the cost and administrative difficulties of single, double, multiple, and sequential sampling plans			C		
38.0.4.5 Select AQL sampling plans from ANSI/ASQC Z1.4			C		
38.0.4.6 Operate AQL sampling plans from ANSI/ASQC Z1.4			C		
38.0.4.7 Use the switching rules applying to normal, tightened, and reduced inspection as prescribed by ANSI/ASQC Z1.4			C		
38.0.4.8 Select single and double rectifying inspection sampling plans using Dodge-Romig for specified AOQL and LTPD levels			C		
38.0.4.9 Operate single and double rectifying inspection sampling plans using Dodge-Romig for specified AOQL and LTPD levels			C		
38.0.4.10 Design a single sampling plan for variables data to meet specified risk levels			C		
38.0.4.11 Operate a single sampling plan for variables data to meet specified risk levels			C		
38.0.4.12 Select sampling plans for variable data using plans selected from ANSI/ASQC Z1.9			C		
38.0.4.13 Operate sampling plans for variable data using plans selected from ANSI/ASQC Z1.9			C		

Unit 38: Quality (cont)	10	12	AD	WS	LL
Competency 38.0.5: Demonstrate knowledge of metrological instruments		I	I		
Competency Builders:					
38.0.5.1 Use steel rules for English and metric measurements		I	C		
38.0.5.2 Use vernier and dial calipers and other vernier instruments		I	C		
38.0.5.3 Use micrometers and vernier micrometers		I	C		
38.0.5.4 Use gage blocks and dial indicators for comparison measurement		I	C		
38.0.5.5 Use the optical comparator to make direct and translation measurements		I	C		
38.0.5.6 Use the rule of 10 to select appropriate instruments for tasks		I	C		
38.0.5.7 Interpret metrological language, including accuracy, precision, repeatability, and reproducibility		I	C		
38.0.5.8 Design gage error short and long studies to determine suitability of measurement instruments for tasks			C		
38.0.5.9 Execute gage error short and long studies to determine suitability of measurement instruments for tasks			C		
38.0.5.10 Interpret gage error short and long studies to determine suitability of measurement instruments for tasks			C		
38.0.5.11 Interpret the total measured variation in a process in terms of the actual process (part) variation and measurement system variation		I	C		
38.0.5.12 Use the bevel protractor, sine bar, and optical comparator to make angle measurements		I	C		
38.0.5.13 Use gage pins or bearings to make interior angle measurements			I		
38.0.5.14 Use thread pitch gages		I	C		
38.0.5.15 Use the three wire and pitch diameter micrometer to measure thread pitch diameter			I		

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Unit 38: Quality (cont)	10	12	AD	WS	LL
Competency 38.0.5: Demonstrate knowledge of metrological instruments (cont.)		I	I		
Competency Builders:					
38.0.5.16 Use thread plug gages and ring gages to check threads		I	C		
38.0.5.17 Use thread plug gages to measure thread hole depth		I	C		
38.0.5.18 Demonstrate exposure to a variety of other dimensional measurement devices, e.g., optical flats, profilometers, etc.			I		
38.0.5.19 Demonstrate exposure to non-dimensional measurement devices, e.g., pressure gages, temperature gages, electrical measurement devices, etc.			I		
Competency 38.0.6: Apply calibration procedures and standards		I	I		
Competency Builders:					
38.0.6.1 Explain different types of calibration errors (zero-set, linearity, periodicity, topical, and illegitimate)		I	C		
38.0.6.2 Explain the hierarchy of calibration and traceability		I	C		
38.0.6.3 Design short calibration checks of calipers, micrometers, and related instruments using gage blocks as standards			C		
38.0.6.4 Execute short calibration checks of calipers, micrometers, and related instruments using gage blocks as standards			C		
38.0.6.5 Explain the calibration requirements of ISO9000 and QS9000			I		
38.0.6.6 Demonstrate knowledge of ISO10012 Calibration Systems Requirements			I		
38.0.6.7 Explain the calibration requirements of ISO10012: QA Requirements for Measuring Equipment			I		

Unit 38: Quality (cont)	10	12	AD	WS	LL
Competency 38.0.7: Use traditional quality tools and methods		I	I		
Competency Builders:					
38.0.7.1 Use histograms		C			
38.0.7.2 Use scatterplots		I	C		
38.0.7.3 Use Cause and Effect (Fishbone or Ishikawa) Diagrams		I	C		
38.0.7.4 Use Pareto charts and the Pareto Principle		I	C		
38.0.7.5 Use flow charts		I	C		
38.0.7.6 Use check sheets		I	C		
38.0.7.7 Use run (SPC) charts		I	C		
38.0.7.8 Use Design of Experiments			I		
38.0.7.9 Use Quality Functional Deployment (QFD)			I		
38.0.7.10 Use Quality Cost Analysis		I	R		
38.0.7.11 Use Just In Time (JIT)		I	R		
38.0.7.12 Use benchmarking			I		
38.0.7.13 Use process reengineering			I		
Competency 38.0.8: Apply Quality Cost Philosophy			C		
Competency Builders:					
38.0.8.1 Identify the four types of Quality Costs (Internal and External Failure, Prevention, and Appraisal)		I	C		
38.0.8.2 Classify cost items into the appropriate categories		I	C		
38.0.8.3 Distinguish when SPC is a Prevention, Appraisal, or Failure Cost			C		
38.0.8.4 Use quality cost models to identify optimum business operating defect rates			C		
38.0.8.5 Interpret process centering and variation as evidenced in SPC charts in the context of Taguchi's Loss Function			C		
38.0.8.6 Use quality cost analysis to identify improvement opportunities			C		

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Unit 38: Quality (cont)		10	12	AD	WS	LL
Competency 38.0.9: Demonstrate knowledge of corporate quality issues			I	C		
Competency Builders:						
38.0.9.1	Define corporate quality in terms of product features, product freedom from deficiencies		I	C		
38.0.9.2	Define corporate quality policy: components and interpretation		I	C		
38.0.9.3	Evaluate quality culture		I	C		
38.0.9.4	Identify internal and external customers		I	C		
38.0.9.5	Describe characteristics for leadership for quality improvement		I	C		
38.0.9.6	Explain importance of top management commitment to quality		I	C		
38.0.9.7	Plan for quality control and improvement		I	C		
38.0.9.8	Identify employee training and development needs		I	C		
38.0.9.9	Identify employee motivation methods		I	C		
38.0.9.10	Design employee performance evaluations			C		
38.0.9.11	Analyze employee performance evaluations			C		
38.0.9.12	Select team members for quality improvement teams		I	C		
38.0.9.13	Identify service quality requirements		I	C		
38.0.9.14	Identify legal responsibilities		I	C		
38.0.9.15	Identify quality data systems and data analysis			I		
38.0.9.16	Evaluate product reliability and safety		I	C		
38.0.9.17	Evaluate customer satisfaction		I	C		
38.0.9.18	Perform quality auditing (internal and third party audits)		I	C		
38.0.9.19	Describe certification systems (ISO9000, QS9000, Baldrige)		I	I		
Competency 38.0.10: Demonstrate knowledge of ISO9000 and QS9000			I	C		
Competency Builders:						
38.0.10.1	Explain the 20 elements of ISO/QS 9000		I	C		

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Unit 39: Production Planning and Control		10	12	AD	WS	LL
Competency 39.0.1: Demonstrate a knowledge of the materials management function within a manufacturing environment				I		
Competency Builders:						
39.0.1.1	Calculate an economic order quantity, taking into account the variables of setup charges, inventory carrying costs, annual usage, and quantity discounts			I		
39.0.1.2	Calculate the ECQ for a group of items incurring major and minor setups			I		
39.0.1.3	Apply the ABC classification of inventory to a particular inventory distribution			I		
39.0.1.4	Calculate a production plan based on usage and inventory build-up or depletion			I		
39.0.1.5	Calculate a forecast using the technique of first-order exponential smoothing			I		
39.0.1.6	Calculate the weighing factor to be used when converting from a running average basis exponential smoothing			I		
39.0.1.7	Prepare a Materials Requirements Plan (MRP) using a time-phased explosion of a production schedule			I		
39.0.1.8	Calculate the amount of reserve stock required by means of a statistical analysis of demand during lead time and the service level desired			I		
39.0.1.9	Construct a Gantt chart for scheduling work-in-process with a minimum lead time			I		
39.0.1.10	Describe the steps in a purchase cycle			I		

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A. APPLYING "QUALITY" PRINCIPLES	A-1 Identify organizational structure	A-2 Identify "needs" of internal and external customers	A-3 Identify internal and external suppliers	A-4 Use control charts	A-5 Interpret control charts (including SPC)	A-6 Use quality measuring devices (metrology)	A-7 Access computer information	A-8 Develop or interpret flow charts	A-9 Employ continuous improvement principles
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B. ANALYZING DATA AND SOLVING PROBLEMS	B-1 Identify variances	B-2 Compare variances	B-3 Interpret results	B-4 Recommend changes	B-5 Implement changes	B-6 Apply quality principles			
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C. APPLYING BASIC MACHINING SKILLS AND PROCESSES	C-1 Demonstrate appropriate safety procedures	C-2 Demonstrate use of English and Metric measurement systems/instruments	C-3 Demonstrate proper inspection techniques according to print specifications and principles of geometric tolerances	C-4 Demonstrate proper use of hand and power hand tools	C-5 Demonstrate basic layout techniques according to print specifications and principles of geometric tolerances	C-6 Demonstrate proper maintenance, setup and operation of power saws, lathes, drilling machines, grinding, and milling machines	C-7 Demonstrate proper maintenance and operation of heat-treating equipment	C-8 Demonstrate proper turning and milling operations with indexable tooling	C-9 Demonstrate precision layout techniques according to print specifications and principles of geometric tolerances	C-10 Demonstrate proper maintenance, programming, setup, and operation of computer numerical controlled (CNC) lathes and turning center and mills and machining center	C-11 Investigate v and carbon electrical discharge machines (EDMs), laser, plasma arc, and water-jet cutting machines
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D. APPLYING BASIC DRAFTING SKILLS AND PRINCIPLES	D-1 Demonstrate proper use of drafting equipment, line and lettering techniques	D-2 Sketch and interpret orthographic views, multi-view projections, and auxiliary views	D-3 Interpret standard sectional, conventional breaks, and special sectional views	D-4 Sketch and interpret axonometric projections, oblique drawings, and exploded assembly drawings	D-5 Demonstrate and interpret the principles of dimensioning, including the application of geometric tolerances	D-6 Demonstrate basic computer-assisted drafting (CAD) skills	D-7 Interpret the basic principles of machine, architectural, and electrical/electronic assemblies and drawings		
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E. APPLYING MANUFACTURING PROCESSES	E-1 Read and document manufacturing procedures	E-2 Identify manufacturing processes	E-3 Relate manufacturing processes to variables (e.g., cost, time, materials)	E-4 Select materials and techniques appropriate to a specific situation	E-5 Apply knowledge of instrumentation	E-6 Identify computer controls	E-7 Follow procedures	E-8 Apply quality principles
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A **MANUFACTURING TECHNICIAN** is someone who is able to assist with the implementation of the manufacturing process from design to finished product.

DACUM TASK ANALYSIS

MANUFACTURING TECHNICIAN

Developed by
THE LAKELAND TECH PREP CONSORTIUM
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HIGHER LEVEL COMPETENCIES

January 14 - 15, 1993

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F. REMAINING CURRENT WITH TECHNOLOGY	F-1 Read trade journals	F-2 Participate in in-house training	F-3 Participate in seminars/workshops	F-4 Participate in formal education
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G. PERSONAL TRAITS/ EMPLOYABILITY SKILLS	G-1 Demonstrate effective verbal, non- verbal and listening skills	G-2 Demonstrate respect for other opinions	G-3 Demonstrate the ability to cooperate with others	G-4 Provide and accept constructive criticism	G-5 Accept responsibility and accountability	G-6 Demonstrate ability to compromise and work in teams/groups	G-7 Demonstrate a willingness to learn others' jobs	G-8 Demonstrate the ability to write instructions, technical reports, logs, summaries, letters and field reports	G-9 Demonstrate the ability to conduct a meeting	G-10 Recognize the importance of setting goals and demonstrate initiative	G-11 Recognize the importance of pursuing continuing education/training
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H. RELATED KNOWLEDGE	H-1 Math: - Numbers and number relationships - Measurement - Data analysis and probability - Algebra - Geometry - Basic Trigonometry
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With Special Thanks and Appreciation to:

Panel Members:

Larry Boehnlein
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Robert Zenz

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